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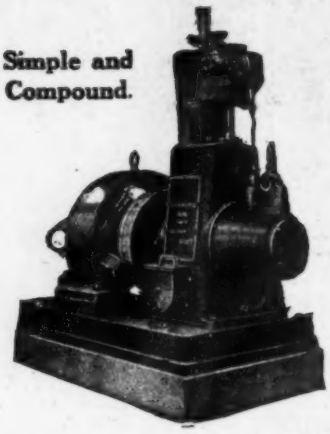

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THE

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ELECTRICAL REVIEW.

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THE PRICE OF THE "ELECTRICAL REVIEW."

During the War, almost exceptionally among technical publications and periodicals of the character of the ELECTRICAL REVIEW, we have refrained from increasing the price. Owing, however, to the constant increases in cost of paper, printing, engraving and production charges generally, we have reluctantly decided that the price from the beginning of this year must be raised to 6d. per copy. The change will not apply to unexpired subscriptions.

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THE TRADE SITUATION IN BRAZIL.

WE commend as deserving of serious study by British manufacturers and export traders the revised report issued by the British Chamber of Commerce in Brazil (Inc.) relating to "British Trade with Brazil." It is unnecessary to emphasise the immense importance of this great country with its population of over 25 millions and its area of 3½ million square miles—"nearly double the area of India, and larger than the United States without Alaska." For business purposes it should be remembered that it is the only country in Latin America where Portuguese is the language, and that the outstanding features of the moment are the development of local industries, a further increase in American competition, and the general prosperity of local merchants. As the recent visits to this country of Brazilian men of eminence have shown, there is a very cordial sympathy with British interests, but the Brazilian Government is naturally anxious to free its country as far as possible from its dependence on foreign goods. It is doing this by encouraging and subsidising the establishment of new industries, by extending its support to coal mining, &c. Certain importing interests will suffer in consequence, but it is hardly reasonable to fear that Brazilian electrical manufacturing will become a serious factor yet awhile, whatever it may do eventually. It is pointed out in this report that it would be folly for the British exporter to count upon any anti-American feeling as a means for defeating American competition which has latterly been steadily increasing. The Brazilian merchant, like others, will "subordinate his private feelings to his interest, and will buy from an American firm every time if it suits him to do so." With regard to German competition, it is worth noting that, during the war, German trade in Brazil was by no means eliminated. The Government permitted the enemy banks to operate with only slight restrictions, and business houses continued their operations unmolested. Our Black Lists notwithstanding, there have been exceedingly few cases where German firms have been obliged to close their doors. Somehow or other they managed to "carry on" by selling both British and American goods, although, of course, their business decreased very considerably.

There is some interesting advice to us at Home with regard to methods for dealing with the future situation. We have to recognise the need for organisation and co-operation both at Home and abroad, and to acknowledge the community of interest as between the banker, the merchant, and the manufacturer; but equally as important, if not more so, is the necessity for the carrying of stocks of British goods by British firms, as a means of introducing them. "The British manufacturer wishing to enter this market must adapt his wares to this market, as the market is not going to adapt itself to his wares." If the German trader is on the ground with certain lines,

it will not be of the least use for the British exporter's agent to go to the buyer and say: "We could do that for you." Why should the buyer trouble to place a trial order with us if he is already getting what he wants without indulging in experimental purchasing? The absence of sentiment must be considered; regard must be paid to every-day human nature. If the British manufacturer wants to cut into German lines, he must be *doing it already*, at the time of his approach, not merely offering to do so. "The most efficient way to introduce British goods is to have them on the market, and distribute them throughout the country." The report advocates the opening of as many establishments as possible by British firms, not only as wholesalers, but as retailers, for retailers gain direct contact with consumers. It is advised that young Britishers should not be confined to office work. They are required to be conversant with the market, knowing the Portuguese language, understanding the Brazilian people—therefore, "put them on the road for a while as salesmen," and let them "travel the country." But, before sending them out, prepare them for foreign trade in the course of their education at Home, "so that young men coming out should not be too green." All of this, and much more like it, that appears in this publication should afford very useful reading for manufacturers, traders, and their staffs. We select one detail more. The Chamber strongly recommends the standardisation of parts of machinery "on the American principle," and proposes that illustrated catalogues be issued with the parts numbered, so that when a piece of machinery is broken or worn out, it is only necessary to telegraph Home for a new piece. Better still though, if possible, have the parts available in Brazil.

While referring to this report issued by an organisation which does not pretend to deal specially with electrical matters, we may remind readers of the pamphlet issued by the B.E.A.M.A., a short time ago, in which Mr. J. M. Glen, as representing a leading British electrical and engineering manufacturer, furnished some useful information of direct electrical value.

German Commercial Propaganda.

Shortly before the outbreak of the war, a large body of influential manufacturers, shipowners, and financiers in Germany conceived the idea of establishing a great scheme of commercial propaganda in other countries for the promotion of the export trade, but the project was never carried into effect on account of the war. Now, however, the proposal has been revived by the "Imperial" Association of German Manufacturers, which is a recent consolidation of the employers' interests in practically all the industries in that country, in conjunction with the Association of German Engineers. The working of the scheme has been entrusted to the Allgemeine Anzeigen Gesellschaft (General Advertisement Co.), which was already financially supported by many iron and steel and other firms in the West of Germany, before the Association of Manufacturers was constituted in its present form about a year ago.

As is reported, the scheme is to be carried out in the first place by the inundation of foreign countries with German journals dealing with all kinds of manufactures, and a technical journal published in German, English, French, and Spanish is to make its appearance shortly, although this is merely the reintroduction of a former practice. All the manufacturing undertakings on the eastern bank of the Rhine are stated to have given effective support to the company in the form of advertisement contracts and subscriptions, in order to ensure an extensive circulation of the technical journal for a period of five years. The F. Krupp Co., for instance, is credited with having undertaken to defray the cost of sending 3,000 copies of each issue to foreign firms during this period. In addition, a trust of the German industrial newspapers is in course of formation in order to work in co-operation with the advertisement company. The company also proposes to establish in foreign capitals publicity agencies, which will play the part of offices for the centralisation and distribution of news for the trans-Atlantic services, which have been placed in the hands of a commercial-news bureau which is associated with the company. As a result of the activities of the agencies, the Association of German Manufacturers hopes to succeed in "exerting a useful influence on the newspapers and commercial journals published abroad."

We ought to be thankful that the Germans are revealing their intentions, because we shall now be able to protect ourselves against the contemplated attacks. The scheme shows distinctly the German frame of mind, which utterly fails to understand that news circulated by Teutons in relation to Germany and German industries will always be regarded with suspicion, and be accepted, in their own words, as scraps of paper. A large amount of political and commercial propaganda was carried on—or, rather, sought to be carried on—in Spanish and Portuguese in South America during the war, but the newspapers, &c., were stopped by the British authorities. Now that Peace has been ratified, it will be impossible, even if we decided to do so, to arrest this new form of propaganda, but we can, at all events, be on our guard against the efforts which are to be made to influence newspapers with tainted news.

The Permanency of High Prices in Germany.

A significant announcement has been made to their customers by the Siemens-Schuckert Works, of Berlin. The notice states that the development of prices in recent months has led to the circumstance that the additions made on account of the dearness of materials and labour—additions charged in excess of pre-war basis prices—have gradually advanced approximately to 1,000 per cent. It cannot be assumed that prices will fall at any time to the level of those which prevailed prior to the war. On the contrary, even if the war-time additions can be partly removed at a later date, it may be definitely reckoned with that the basis prices will always be several times greater than those in pre-war times. As a consequence, the firms belonging to the price bureau of the Central Union of the Electrical Industry have decided to increase the basis prices and reduce the war-time additions to an equivalent extent. The new basis prices have been fixed at three times those which obtained in the first half of 1914. The only exceptions apply to the price lists for machines and motors constructed with substitute metals, and the prices of machines with copper and aluminium windings; and in these cases the quotations have only been doubled, as they had already been raised by 50 per cent. as compared with the prices in 1914.

Little Things that Count.

Years ago, enterprising business correspondents in a part of the world which shall be nameless, took unto themselves a reputation for slimness. They "forgot" to stamp their letters sufficiently; didn't know the rate; or were too busy "getting on in the world" to attend to such trivialities. By the hundred their underpaid communications reached us, and with British long-suffering we kept on smiling as we paid the excess charges at this end. One letter looks very much like another; and you never know, you know, what it may contain, until it is opened. There is a limit to human forbearance though, and it was reached when about half-a-dollar was paid on what proved to be a manufacturer's pamphlet. Is it to be wondered at that traders so neglectful of minor courtesies were criticised even by their own authorities because they in those days lacked aptitude for building up foreign trade?

What utter folly it is to begin by making a bad impression upon the man whose favour you desire to gain; how is he to know that that failure to pay sufficient postage is not a type of the other ways in which you will take advantage of him, on a larger scale, if you get the chance?

We began this comment by recalling the past faults of others; as we proceeded, we found ourselves writing in the present tense and as though such errors were possible from this side too. Well, unfortunately, that is just what they are, and more than possible, for H.M. Consul-General at Antwerp has sent home a protest, and small wonder at it, seeing that 30 per cent. of the letters and packages sent by British firms in response to his appeal for catalogues and samples arrived under-stamped. In two days, 38 francs were expended on taxed letters. The *Board of Trade Journal* wisely publishes a hint to *commercial houses*—for they are the offenders—on the importance of ensuring the correct stamping of the foreign mail. In these days of great concerns and big ideas and strong policies, this may seem to be a trifling point, but after all, it's the little things that count!

Technical Books.

WITH the contention of Mr. A. C. Purday in our "Correspondence" columns to-day, that the date of publication should be provided in every book, we fully agree; and a mere reprint should never be misnamed "new edition." It is also to be regretted that so many authors think it necessary to start with the most elementary theory, but this practice is not now so common. We feel, however, that our correspondent's suggestion has little prospect of fulfilment. There would be "too many cooks," and however excellent the standardised books might be in substance, the loss of individuality of style and originality of treatment would be deplorable. A theoretically perfect standard diet might be developed by a Committee of Physiological Experts—but who could partake of it at every meal, or even at one meal daily, without ultimate loathing? We do not agree that an adequate selection of books cannot be made without excessive overlapping; there is to-day an embarrassing choice of good books on almost every subject with which we are concerned. It is true that, as in every other case, the nominal cost of technical books has greatly increased, but the "young engineer or student" is apt to under-estimate the intrinsic value of a set of good books. In this the English should learn from the Scots.

The Liabilities of Tramway Companies.

THE case of the Postmaster-General *v.* Blackpool and Fleetwood Tramroad Co., recently reported in our pages, illustrates very clearly the heavy liabilities imposed upon electric tramway companies. So long ago as 1896 the defendant company took statutory power to lay tramlines, and, incidentally, underground cables in Blackpool. Their Act contained a clause protecting the works of the Postmaster-General. In 1914 the P.M.G. laid wires within 7 ft. of the defendants' electric lines. A leakage from the latter occurred in 1916, the covering of the plaintiff's cable being electrolytically affected. Subsequently the danger was removed by the bonding of the plaintiff's cable to the tramway track, but the plaintiff, nevertheless, brought an action to recover the expenses to which he had been put in making good the damage. The Act above referred to provided that "if any telegraphic line of the Postmaster-General is injuriously affected by the construction by the company of their electric lines and works, or by the working of the undertaking of the company, the company shall pay the expense of all such alterations in the telegraphic lines of the Postmaster-General as may be necessary to remedy such injurious affection." It was held that neither the fact that the defendants had used all reasonable means to prevent injurious affection, *nor that the plaintiff by placing his cable in unnecessary proximity to the defendants' line had courted the injury*, nor, again, that he had, when laying the cable, omitted to take the reasonable precaution of bonding it to the defendants' lines, afforded any defence. This interpretation of the statute may be correct, but it certainly leads to a rather startling result. Logically, it follows that no matter how careless the Postmaster-General, or his servants, may be in the laying of a cable, the cost of all the evil results which follow from proximity to an electric tramway must be borne by the tramway company.

I.E.E. Informal Meetings.

THAT these meetings are informal to a high degree was evident on Monday evening last, when a discussion opened by Captain F. H. Masters, O.B.E., on "The Functions of a Trade Journal," rapidly degenerated into a discussion of the merits and demerits (mainly the latter) of the various organs of the electrical industry, and touched upon questions of policy, advertising rates, situations vacant, and combustibility—or arson. Much was said with regard to the make-up of the respective journals, and on this, as on other points that were raised, we could write a good deal; we will content ourselves, however, with the remark that the one crucial test of the satisfaction of the reader is the numerical test, and a constantly expanding circulation is an argument that admits of no refutation.

The author's able exposition was described as a hat-stand without pegs; perhaps that was the reason why some of the speakers talked through their head-gear. The discussion was lively and well-sustained, though the attendance was absurdly small—due, no doubt, to the uninviting title of the subject.

We are pleased to say that the journalistic atmosphere which has pervaded recent "Informal Meetings" has now been dispelled, and a very attractive programme has been put forward for the remaining meetings of the session; it will be found in our "Institution Notes" to-day. That Major T. Rich's "Engineering Experiences During the War" will be of absorbing interest is certain, and we confidently anticipate a full house on that occasion.

The 10s. Coal Rebate.

THE Coal Controller is much to be congratulated on the astute way in which he has extricated himself from a difficult position. He had the thankless task of devising some way or other by which the benefit of the 10s. reduction on household coal should enure to the domestic electricity consumer. It was a most complicated business. But he found a delightfully easy way out of his perplexities. He simply transferred the whole thing to the shoulders of the electricity supply undertakers. The Coal Controller was bland, the undertakers were guileless. Result—the Coal Controller has finished his task, but theundertakers have just begun theirs, as they will probably find to their cost before it is through.

Note what he has got them to agree to do. They will go to their coal merchants and get a rebate of 10s. per ton on such coal as they use for "household" electricity supply. They will then pass the whole of this on (less 5 per cent.) to those consumers who are entitled to it. By this procedure they lay themselves open to endless criticism and misunderstanding. There is no way of showing a consumer that he is being treated properly as regards the amount of his allowance. Consumers will get different rebates according to the company or municipality which is supplying them. The amount will be quite trivial compared with the great trouble given. In many cases the rebate will probably be less than a farthing per unit. As to the work that will be entailed, and the difficulties bristling round the whole matter, it is only necessary to see the documents placed in the hands of the undertakers, which were summarised in our last issue.

Altogether the electric supply undertakings would certainly seem to have had a reasonable case for refusing to become agents to hand to the public this Government "dole," unless it was done in some simple and direct manner, and one which placed no responsibility upon the undertakers. As it is, the Coal Controller now stands aloof, and leaves the problem to be settled by the mutually hostile triad—the coal merchant, the undertaking, and the consumer. We say mutually "hostile," since if they are not so when they begin, there seems every likelihood that amicable relations will not stand the wear and tear of carrying out the Controller's "prescription." And the undertakers have consented to be put in a position where they can neither tell the disgruntled consumer to go to the Coal Controller, nor—to the devil.

THE ELECTRICAL EQUIPMENT OF PALMERS SHIPBUILDING AND IRON CO.'S WORKS.

Messrs. Palmers Shipbuilding and Iron Co., Ltd., which has for long been renowned for its large operations in shipbuilding, engineering, iron and steel manufacture, and allied industries, has during recent years made extensive additions and improvements at its two establishments at Jarrow and Hebburn-on-Tyne, but more particularly in connection with the iron and steel works at Jarrow.

The firm has for over half a century been one of the largest concerns of its kind in the United Kingdom, and at present its employés number about 10,000. The works will be interested in some particulars of the generation of electricity and adoption of electric driving at the Jarrow works which we are able to give.

During the last few years considerable progress has been made in the adoption of electrical machinery for use in the iron and steel works, and also in the shipyard. One of the chief reasons for this advancement in the adoption of electric driving is the fact that the gas emitted from the blast furnaces, which was previously, to a large extent, wasted by passing away into the atmosphere, is now

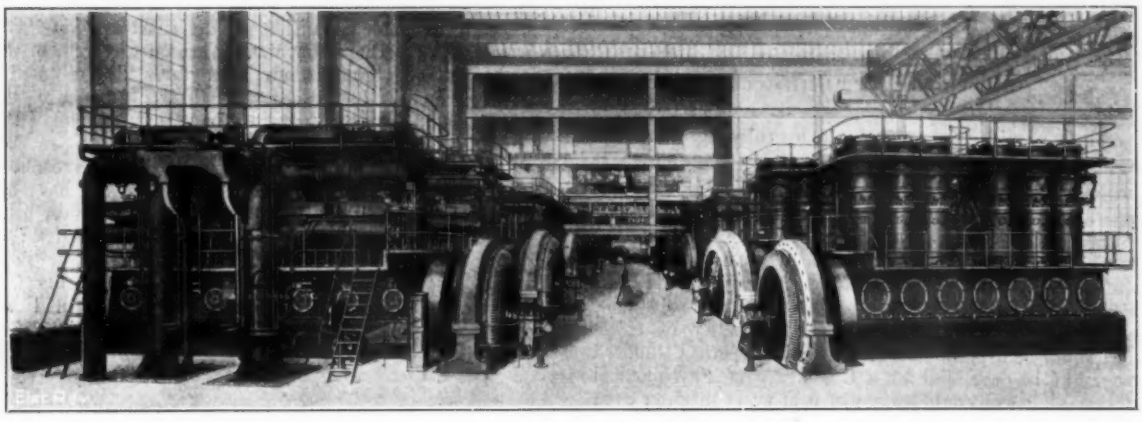


Fig. 1.—Power House at Messrs. Palmers Works, Jarrow.

cover an area of about 150 acres, with a river frontage of nearly a mile, and consist of two large shipbuilding yards, two graving docks (one of them the largest on the North-East Coast), large engine and boiler works, blast furnaces, steel works, several foundries, and forge and galvanising works, and include within themselves the entire range of operations from the smelting of the ore to the complete equipment of the vessel. Amongst the vessels built for war purposes are some of the largest ships constructed for the

cleaned to such an extent that it is possible to utilise it for driving large gas engines, which are used both for the generation of electricity and for driving the large blowers required for blast-furnace work. Previously the gas was used simply in a dirty or crude state for the heating of stoves and steam-raising in boilers.

The gas-cleaning plant is arranged on the well-known Halberger-Beth principle. The system consists of a primary cooler, re-heater, filtering compartments, and fans, with fina

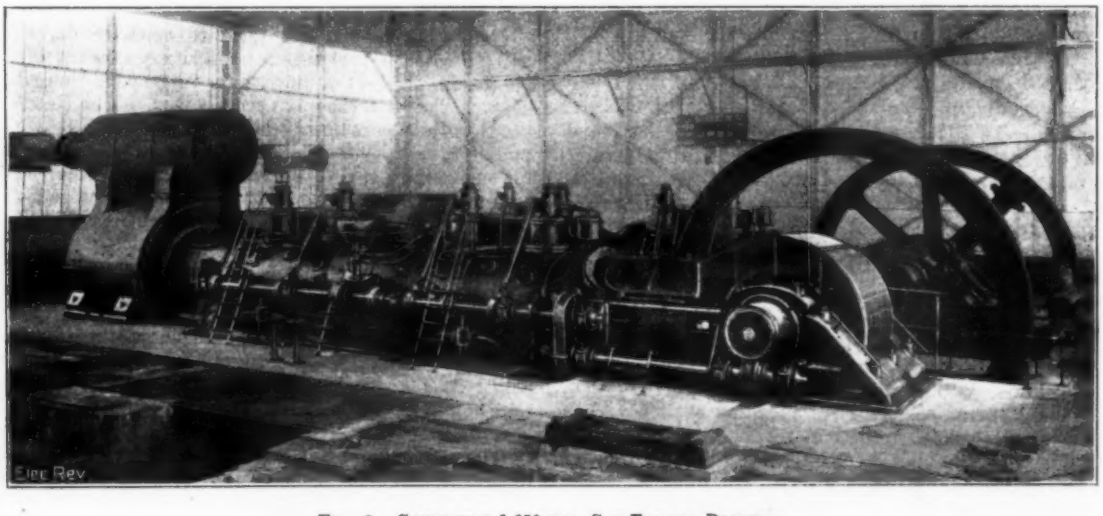


Fig. 2.—Galloway 1,650-h.p. Gas-Engine Blower.

British Navy, while the merchant tonnage consists of every class—cargo and passenger steamers, refrigerated meat vessels and large oil tankers. The firm has, indeed, built about 900 ships of all descriptions, and it is gratifying to know that the prosperity of the company has gone hand in hand with the developments and extensions which have during recent years distinguished its management.

It is not possible within the limits of our space to describe in detail the many departments of the firm, but our readers

cooler and dryer. The gas from the blast-furnace down-comers passes along a zig-zag main which is fitted with a number of dry dust-catchers, after which it enters the primary coolers, and is reduced to about 160° F.

The cool gas next enters the reheaters, where it is heated to a steady temperature of about 175° F. by means of steam coils, the bottom of this heater, as well as the bottom of the neighbouring filtering compartments, being provided with a screw conveyor for carrying the precipitated dust

into dust-catchers, from whence it is removed for the purpose of extracting by-products. After passing through the heaters the gas is conducted into a filtering chamber, which consists of a number of bags through which the gas is drawn by means of fans. The clean gas from the fan delivery is divided up, one portion passing to the boilers and stoves, the rest to the gas engines; the portion required to drive the gas engines is passed through a further, or final, cooler and dryer, the gas then being purified to such an extent that the dust content is reduced to 0·002 gramme per cubic metre, a lower figure being often obtained.

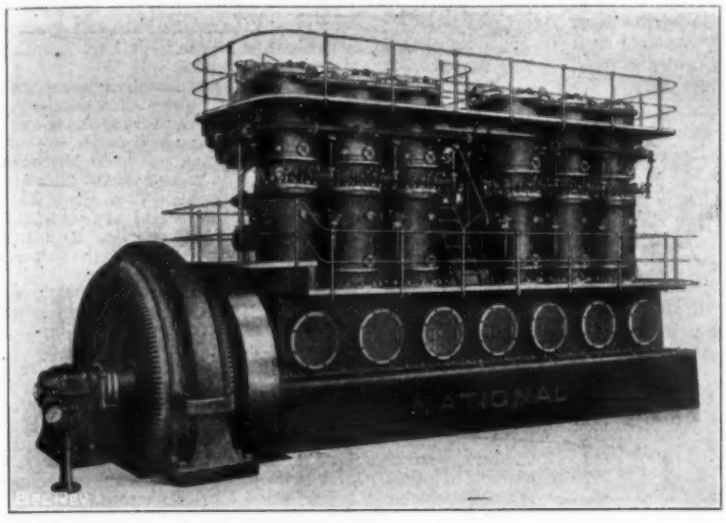


Fig. 3.—National 1,500-h.p. Gas-engine Alternator.

In the engine house (fig. 1), three large horizontal, low-speed Galloway gas engines (fig. 2) have at present been completed, and a fourth one is now being installed, each of them being of 1,650 H.P., for the purpose of driving the air blowers for the supply of blast to the blast furnaces, and, in addition, five 1,500-H.P. engines (fig. 3), built by the National Gas Engine Co., have up to the present been running direct-coupled to three-phase, E.H.T. alternators; these engines are of the vertical, 12-cylinder type, two cylinders working in tandem on each of six lines, the speed of the engines being 200 R.P.M. The alternators are designed to give an output of 1,330 K.V.A. at 40 cycles. Two further engines of this type are being erected, and, in addition, a 1,000-H.P., 8-cylinder, 4-line tandem engine has been working for a considerable time direct-coupled to a 700-KW. D.C. generator arranged with a choking coil necessary for three-wire balancing.

The three-phase supply passes from the H.T. switchboard, which is arranged on the remote control principle, to two 700-KW. Westinghouse rotary converters for an additional supply of direct current required in the works; a heavy three-phase ring main passes from the H.T. board to four static sub-stations situated in different parts of the iron and steel works and shipyard, the H.T. pressure of 5,500 volts being transformed down to 440 volts for the general A.C. supply.

(To be concluded.)

THE COLLECTION OF REVENUE.

By A. C. GLOVER.

Collection of revenue may be hard and tedious work or light, bright and simple, and this short article is to assist those who seek the happier way. Instead of the old bound books for collection, I intend substituting loose leaves, arranged in streets or roads, and in the order of callings, as in the case of meter readings. Each division or district or a number of roads will be placed in a loose-leaf binder and lettered, in preference to being numbered. A street index is essential, and one is illustrated below on the vowel principle, which may hang in the office for immediate reference.

STREET INDEX.

A	District letter.	E	District letter.	I	District letter.	O	District letter.	U	District letter.
Strand	D	Cheapside ...	C	Bishopsgate ... King Street ...	B C	London Road ...	E	Ludgate Hill ...	A

The district letter may be placed on the consumers' accounts before dispatch, *e.g.*, C 2,006. A number of consumers call to settle their accounts, and, for example, Johnson, of Cheapside, comes to pay his account, which is numbered C 2,006. The district letter, reference number, and amount are transferred to a cash-received sheet with a banking column. From this sheet the collector's "C" book is entered. The system has manifold advantages over the old way. The leaves may be placed in any convenient order; the system will allow of growth or revision with little trouble. A district book may hold 150 to 200 consumers' collection sheets, 8" × 5", convenient for a large pocket. After single letters are exhausted, double letters follow, *e.g.*, AB, AC.

COLLECTION FORM.

ADDRESS.....

NAME.....

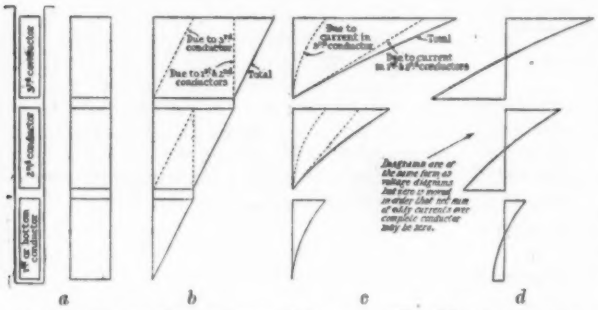
Month.	Amount.	Arrears, Brot. forward.	Total due.	Amount paid.	Receipt number.	Arrears, Crd. forward.	Collector's signature.
January							
February							

EDDY CURRENTS IN STATOR WINDINGS.

Mr. H. W. Taylor, A.M.I.E.E., read a paper on the above subject at Birmingham last week before the South Midland Centre of the Institution of Electrical Engineers. The paper, which does not lend itself readily to abstracting, attacked the problem of the elimination of eddy currents from stator conductors in a synthetic rather than an analytical manner, with a view to dealing with some of the more advanced problems which have demanded consideration in recent years. Development of this subject on these lines leads to an approximation, which considerably simplifies the calculation of most practical cases.

In the usual analytical investigation a symbol is taken to represent the complex current distribution in the conductor, and after operating upon the symbol in accordance with each physical relation, the result is equated to the original symbol, thus forming a differential equation, the solution of which only discloses in general details the nature of the current distribution as represented by the symbol. The exact details are subsequently determined from a knowledge of the distinctive features of the problem in hand.

The synthetical method starts by assuming the distribution of current to be uniform, as would be the case if the external electromotive force were the only one under consideration.


3rd conductor
2nd conductor
1st or bottom conductor
Due to 3rd conductor
Due to 1st & 2nd conductors
Total
Due to current in 3rd conductor
Total
Due to current in 1st & 2nd conductors
Diagrams are of the same form as voltage diagrams but care is needed in order that net sum of eddy currents over complete conductor may be zero.
a
b
c
d

(*a*).—Current Distribution Diagram. (*b*).—Magneto-motive Force Diagram. (*c*).—Flux Linkage or Voltage Diagram. (*d*).—Eddy Current Diagram of First Order.

It then proceeds to determine the simple algebraical expressions for the physical quantities which, in turn, would result from this uniformly distributed alternative current. It is thus possible to calculate a local current in the conductor, which can be conceived to be superimposed upon the original current in order to satisfy the alternating flux set up by the original current. This A.C., whatever its actual value in any lamina, is everywhere 90 deg. out of phase in time with the original current. The next procedure is to take the eddy current thus found, called the eddy current of the first order, and carry through the same processes as were applied to the original uniformly distributed A.C., and what may be called the eddy current of the second order, which will flow in order to satisfy the alternating flux set up by the eddy current of the first order, is then found. This second eddy current will, in turn, be 90 deg. in time phase behind the first eddy current., *i.e.*, it will be in exactly opposite phase to the original uniformly distributed current. In the same way it is possible to go on indefinitely calculating successive orders of eddy currents, each of which will lag behind the previous one by 90 deg. When the calculations have been carried to a sufficient extent it will be found that the total resulting current is the same as that obtained by the analytical method.

The value of the present method lies in the fact that for most practical cases it is only necessary to calculate the eddy currents of the first order.

The simple mathematics for the proposed method as applied to the simplest case, *viz.*, that for the bottom conductor in a slot are then given; the process is indicated graphically in fig. 1.

The distribution of the first order of eddy current across the depth of the conductor is parabolic. The "extra loss factor" is defined as the ratio of the extra loss due to eddy currents only to the loss which would arise from uniform distribution of current. If all eddy currents beyond the first order can be neglected, the calculation of the extra loss factor is simple.

When the eddy-current losses in the second conductor are considered, it is found, fig. 1, that the flux which passes across the conductor depends not only upon the current in the conductor itself, but also upon the currents in the conductors below it. The graphical representation of this expression is a parabola of the same form as was found for the bottom conductor, with the addition of a straight line, the slope of which is proportional to the number of conductors below the one in question. Further, the height of the parabola at the end of the conductor is half the height of the straight line when drawn for one external conductor, fig. 1 *c*.

A full appreciation of these points is important in many of the subsequent sections of the paper.

The limitation to the use of approximate expressions for loss factor fully covers the practical range of conductors.

Under given conditions there is a critical depth of conductor which gives a minimum loss, which arises out of the fact that when this critical depth is exceeded the rate of increase of the eddy-loss factor is greater than the rate of increase of the depth of the conductor. This point may be very conveniently investigated by means of the approximate formula proposed, and the argument applies both to individual conductors and to the average value of the loss factor for all the conductors.

The author next considers losses in top conductors when subjected to the external influence of currents out of phase to those they themselves carry. For instance, in a multi-turn coil in which there are eight isolated conductors in the same slot, the losses in the four bottom conductors are calculated in the manner already indicated, as they all carry current corresponding to, say, phase *a*. The fifth conductor, however, carries current of another phase, say, phase *b*, but is subjected to the external influence of flux arising from four conductors of phase *a*. Similarly the sixth conductor carries current of phase *b*, but is subjected to the external influence of one conductor of phase *b* and four of phase *a*, and so on.

The losses in a conductor divided into a number of sections all connected together at the ends of the conductor are of importance, since this is the simplest method of minimising the eddy losses. The case of the infinitely laminated conductor is within the range of the present approximate treatment; the extra-loss factor is that of a solid conductor reduced by the square of the ratio of the core length to the total length of the conductor, *i.e.*, in the ratio 1 : b^2. The more practical case of a finite number of laminations will give rise to an extra-loss factor intermediate between the solid and the infinitely laminated conductors. An interesting case of unequal sub-division is considered in the original paper where adjacent conductors in a bundle of six conductors are unequally divided in order that the separate sections may keep their proper places during the insulation process. Fig. 2 has been plotted from the formulæ in this section, and relates: (*a*) (full lines) to a conductor divided into laminations, namely, 2, 3, 4, and 5 parts to give the same total depth. Different curves relate to the first, second, third, and fourth of such conductors from the bottom of the slot. (*b*) (dotted lines) to similarly laminated third and fourth conductors in slots where the current in the top conductors differs in phase from that in the bottom conductors by 60 deg.

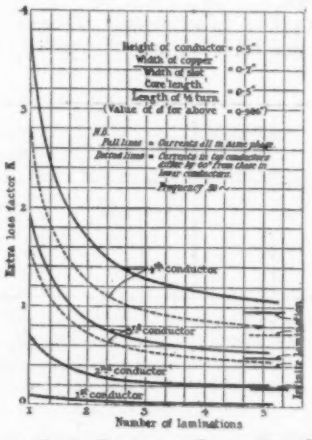

Height of conductor = 0·5"
Width of copper / Width of slot = 0·7"
Core length / Length of ½ turn = 0·5"
(Value of d for above = 0·385")
N.B.
Full lines = Currents all in same phase
Dotted lines = Currents in top conductors differ by 60° from those in lower conductors
Frequency 50 ~
Extra loss factor K
4th conductor
3rd conductor
2nd conductor
1st conductor
Infinite Lamination
Number of laminations

Fig. 2.—Extra Loss Factor in Laminated Conductors.

The author next considers in detail some of the cases which arise in practice, from which he passes on to the question of losses in conductors and coils in which insulated laminations are successively transferred.

The synthetic treatment is applied in the body of the paper so far as to deal with the most practical cases which will arise. An appendix is added in which the use of this method in the derivation of the complete factors is briefly dealt with, and in which the similarity between eddy currents and transmission line problems is noticed. In a second appendix the author shows how the approximate calculation of irregularly shaped conductors may be expeditiously carried out by developing and calculating step by step an equivalent transmission line from a knowledge of the mechanical shape and dimensions of the conductor.

Discussion at Birmingham.

Mr. F. H. Clough said that with increasing sizes of electrical machinery, especially turbo-alternators, the size of slot had grown very much, and it had become necessary to fully understand the causes which produced additional losses in the copper conductors so that suitable means could be adopted to avoid these losses. The author had in a proper engineering way attacked the problem from a physical aspect, and had used mathematics only as a means of solving the physical problems. He had thereby been able to simplify the mathematical part of the problem and evolve a method whereby practically all types of windings could be calculated comparatively simply. The paper marked a distinct step in progress in the design of electrical machinery.

Mr. R. G. Jakeman, after discussing briefly a certain mathematical feature of the paper, said the expressions "constant" and "variable" eddy currents looked strange at first, but he (the speaker) understood that a "constant" eddy current was one which was uniformly distributed. With regard to stranded conductors and the effect of compression on eddy currents, if the cable was very highly compressed, it was possible for the strands to cut into one another, and so form practically a solid conductor.

Mr. W. M. Cranston explained that the author had brought forward one or two methods of crossing over laminations in conductors, thereby eliminating to a large extent the eddy current loss. That this was of great importance might readily be appreciated when it was considered that the only alternative at present available was the adoption of a completely stranded conductor. The latter to reach its maximum efficiency should have its strands completely insulated throughout the whole of its embedded length, and should have such a pitch that a multiple of the pitch would exactly coincide with the length of the iron core. In normal practice neither of these features was completely obtained, but the resultant loss was usually so small that it would be found to be less than the eddy-current loss in the individual laminations of the interconnected conductor. The stranded conductor, however, cost about 50 per cent. more than a solid bar of the same dimensions. In large machines this economy would go a long way towards paying for the extra connections, and might induce manufacturers to adopt the proposed systems in spite of increased risk of breakdown due to the multiplication of connections. In smaller machines they were content to suffer the inconvenience of eddy currents, but designers were apt to attach too great importance to the depth of copper for minimum loss. With regard to the depth of copper for minimum intensity of heat dissipation, the author had given valuable figures. These showed that the depth of copper might under certain conditions be increased by about 30 per cent. with advantage to the machine. Of course, the losses in the slots were increased, but the gain on the overhang might more than compensate for that, and might result in a more efficient and cooler machine. In certain cases even this depth might be exceeded with impunity.

Dr. M. Kahn said the author had given a simple solution for each case which might arise by considering only the eddy currents of the first order. To neglect the eddy currents of higher orders was certainly justified, as an approximate knowledge of the increase of the copper losses was all that was required. In considering the losses in conductors consisting of a number of laminations connected solidly together at the ends, the statement that the extra-loss factor in case of an infinitely laminated conductor was reduced by the square of the ratio of the core length to the total length of the conductor seemed not to be quite correct; it neglected the fact that the losses in the part of the conductor outside the slot were increased by laminating the conductor. In the case of a solid conductor the alternating current was in the end winding practically uniformly distributed over the whole conductor, and the copper loss there equalled the loss which would take place with a corresponding direct current. If the conductor were laminated, and the laminations so insulated that no current could pass from one lamination to another, the loss per unit of length in the external part of the conductor and in the part of the conductor in the slot would be equal. In the case of stranded conductors where the strands were arranged in spirals the voltage between the various strands was very small, as each strand changed its position continuously and completed a cycle of transposition in each pitch of the spiral. The resulting voltage between strands was smaller than the voltage drop necessary to allow current to flow through the surface contacts between the various strands. In the case of a laminated conductor where the laminations were joined at the end of each half turn the voltage between the laminations was higher. Even so, the surface drop might still reduce the currents flowing between laminations in the end winding to negligible amounts, if the number of laminations was large. If the number of laminations was small, or if the ends of the laminations were not joined up each half turn, insulation was, of course, essential.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Brush Holder.

A new "automatically constant pressure" brush holder for dynamo-electric machines has been recently patented by Mr. C. M. Owen, of "Langstone," Avenue Road, Abergavenny (Mon.), wherewith an attempt is made to obtain a pressure upon the brush which automatically remains the same from the time the brush is put in new until it is removed worn out. No attention or hand regulation is required. The arrangement of the mechanism is easily seen from the drawings, fig. 1; the combination is so designed that the interaction of the spring and the two arms of the lever is such that the pressure upon the brush remains substantially constant during the wear of the brush. The means for adjusting the tension of the spring when desired comprises a threaded plug 14 screwed into the spring 8, the thread on the plug corresponding to the coils on the spring and the plug having a threaded extension 15 which is screwed into a saddle piece 16, supported in bearings, so as to be rotatable, in the arms 5, 5. When the adjusting means is employed the saddle piece 16 takes the place of the rod 7. The pitch of the thread on the plug 14 is the same as the pitch of the thread on the extension 15. A spring washer 17 and a nut 18 are provided for tightening purposes and a clamp 19 is disposed over the outside of the spring and the plug 14.

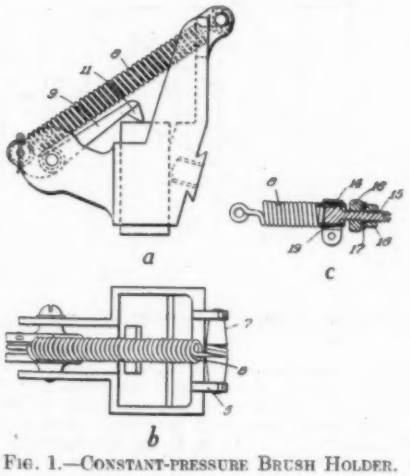


Fig. 1.—Constant-pressure Brush Holder.

In operation, as the brush wears away it descends in the frame and the lever 9 moves about its pivotal point. During this movement the end of the arm to which the spring is attached moves so that the effort of the spring acts at a greater distance from the pivotal point, and, though the pull of the spring becomes less, due to the movement of the arm, the moment acting on the lever remains substantially constant during the wearing away of the brush.

In cases when it may be desirable to alter the tension of the spring, the clamp 19 and nut 18 are loosened and the plug 14 is screwed into or out of the spring, whereby fewer or more coils of the spring are put into operation as desired. After adjustment, the clamp 19 and nut 18 are tightened. The pressure increases slightly from the time the brush is put in new until it is half worn out, and then decreases by the same amount until the brush is fully worn out. The initial and final pressures should, therefore, be equal. The slight increase in pressure may be made as small as desired by small increases in the size of the brush holder.

B.T.H. Workshop Lamp Bracket.

Although the present tendency in industrial lighting is to rely exclusively on general overhead illumination wherever possible, there are still some conditions where it is necessary to use additional local units. The important thing in local light-

ing is that the light should come from the right direction. This means that the unit must be adjustable and under the complete control of the mechanic, because he will probably have to change his position or the position of his head and hands from time to time, which will generally require a corresponding alteration in the direction of the light.

To comply with these requirements the BRITISH THOMSON-HOUSTON Co., of 77, Upper Thames Street, E.C. 4, has designed an adjustable workshop bracket (fig. 2), which consists of a single, double, or triple extension arm, each section being made of two pieces of angle steel clamped together to form a hollow square tube, through

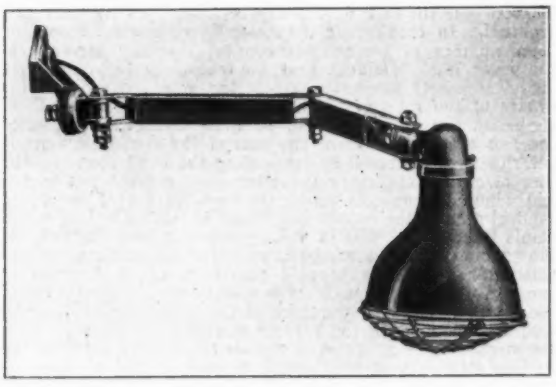


FIG. 2.—B.T.H. WORKSHOP BRACKET.

which the conductor is threaded. The rear section is attached by means of a bolted joint to a projection on the cast-iron back-plate, this projection being in turn secured to the back-plate by a turntable joint, the combination giving a universal movement. The various sections are connected together by means of bolts and lock nuts, while the reflector unit, consisting of reflector, combination cap and gallery and lampholder, is attached to the end of the bracket by a universal joint. The standard is the double extension bracket illustrated, which, when fully extended, is 27 in. in overall length. This bracket, which can be fixed to any horizontal, vertical or oblique surface, is equipped with a small intensive type Mazdalux reflector, fitted with a wire guard, which can, if desired, be sealed in position to prevent unauthorised interference with the lamp. The bracket can be arranged to throw the light in or from any desired direction without alter- to retain any position, but not too stiff for easy movement. without loosening the joint nuts, which are just tight enough to retain any position but not too stiff for easy movement. They can be tightened in an instant should the necessity arise.

Patent Wiring Connector.

Mr. J. DYSON, Aldermanbury, Bradford, has recently placed a new departure in small wiring connectors upon the market. As will be seen from the illustration (fig. 3), both the connector and the porcelain are slotted, enabling the wire to be slipped in without being cut. A grub screw through the top

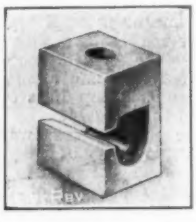


FIG. 3.—MOSS'S PATENT OPEN SLOT CONNECTOR.

of the porcelain clamps the branch wire into position. By this means it is possible to tap off the main wires while they remain *in situ*. The inventor, Mr. Harry Moss, informs us that he designed and made the first models of this connector while on active service in France.

Electricity in the Home.—The results of an interesting experiment in domestic electrical installation are reported from Glasgow. Two houses were selected, and electricity was installed and used exclusively for lighting, heating and household appliances. After more than a year, the total costs were calculated and found to be £32 per annum in one case, and £35 in the other. The occupants of both houses were absolutely satisfied with the results, and express a preference for electrical methods as being cleaner, healthier and more economical.

TEXTILE MILL ELECTRIFICATION.

INDICATIONS of the growing importance of electricity in the manufacture of textile goods are afforded day by day by the reports of applications by mill owners for the installation of electrical power, which are constantly being received. The production of textiles requires above all things a careful attention to the regulation of machine speeds. There is a certain maximum limit to the speed of textile mill machinery which, if exceeded, endangers the safety of the yarn and causes an enormous amount of trouble.

On the other hand it is necessary to run machines as near to this limit as possible in order to obtain the greatest possible

FIG. 1.—THE "WITTON" LOOM MOTOR.

output. Speed variation was a source of considerable loss to manufacturers in the days of the uncertain mechanical drive, and even with modern non-electrical methods it cannot be entirely eliminated, but by the application of a motor drive the variation in speed can be reduced to a minimum.

Another very costly feature of the mechanically (*i.e.*, non-electrically) driven mill is the amount of power lost in transmission. If the source of power is a steam engine it is necessary to arrange a complicated system of belts and pulleys,

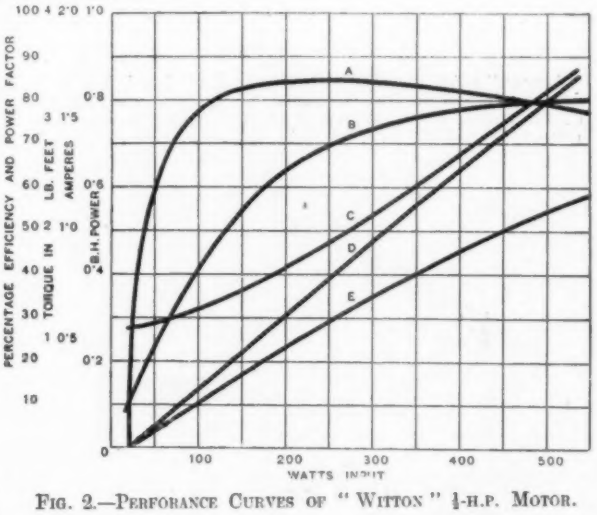


FIG. 2.—PERFORANCE CURVES OF "WITTON" ¼-H.P. MOTOR.

and probably chains and gears. A mill receiving electricity from a central station will probably require a transformer to reduce the supply pressure to one applicable to the driving motors. This comparison may seen only slightly to favour the electrically-driven mill; it is in the intervals between working periods that its superiority is more pronounced.

If the machinery of a steam-driven mill has to be shut down for a short interval—up to, say, two days—it is usual and perhaps advisable to keep the boiler fires banked. This, of course, is a great waste of fuel—a mill provided with electrical driving can be shut down without incurring this loss. To meet the special conditions occurring in the driving of textile mill machinery the General Electric Co., Ltd., has designed the "Witton" motor (fig. 1). This is entirely en-

closed to exclude dust and scraps of material. It is mounted on a small base plate, and supported at one end by a spring which keeps the transmission belt tightened automatically. The "Witton" motor is made in three sizes—½, ¾, and 1 H.P. Characteristic curves of performances of a ½ H.P. motor of this type are given in fig. 2. It will be seen from this record that at half-load the motor's efficiency is 85 per cent. At about 60 per cent. of full load its efficiency rises to 86 per cent., and an 80 per cent. efficiency is maintained at full load.

The question whether to install generators in the mill or to take in a supply from an outside undertaking is one that must be settled after close investigation of local conditions, and is purely a business consideration.

If the supply from a local authority is direct current it is usual practice to install rotary converters to effect a change to A.C., providing separate exciters to maintain a constant speed during changes in the load.

FIG. 3.—ELECTRICALLY-DRIVEN WEAVING SHED.

It has been found that for various reasons A.C. is more satisfactory for this class of work than D.C. The chief points in the former's favour are, first, cost of plant in cases where plant has to be purchased. Secondly, an A.C. motor runs almost synchronously with the generator, which renders the speed variation very small compared with a D.C. motor, the amount of "slip" being not more than 5 per cent. from full-load to zero. Then the A.C. motor has greater efficiency, and requires less and simpler starting gear than a D.C. machine. Although the employment of A.C. motors is advisable, it by no means follows that D.C. machines cannot be used, in fact circumstances will in some cases compel their use.

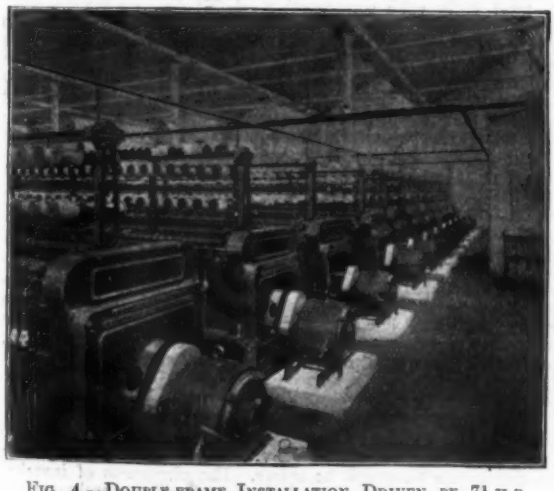


FIG. 4.—DOUBLE-FRAME INSTALLATION DRIVEN BY 7½-H.P. "WITTON" MOTORS.

Small mill alternators with capacities up to 400 KW. may be driven by high-speed reciprocating engines, but in larger installations the employment of steam turbines has been found to be more satisfactory, as the generators can be direct-coupled, minimising the transmission losses.

Another question which arises upon the installation of electrical plant is whether it is better to provide a separate motor for each machine or to drive groups by larger motors. From the efficiency point of view the individual drive is no doubt better than the group drive, but the cost of the former compared with that of the latter presents a difficulty if capital is limited. The absence of overhead gear is one of the many advantages of the direct-drive system; this is very clearly illustrated in fig. 3, which is a photograph of a typical weaving shed in a large textile mill, and fig. 4 showing a double-frame installation driven by 7½ H.P. "Witton" motors.

We are indebted to the G.E. Co. for the adjoining illustrations, which appear in the recently issued Bulletin No. 11 bearing the same title as this article. The Bulletin contains a great amount of interesting information and 40 illustrations, chiefly of textile mills equipped by the G.E. Co.

THE FARADAY SOCIETY.

AN ENGINEERING APPLICATION OF ELECTROLYTIC IRON DEPOSITION.

AT the December meeting of the Faraday Society, LIEUT. W. A. MACFADYEN described a process that had been worked out for the Electrometallurgical Committee of the Ministry of Munitions, and very usefully applied in the war area for the repair of aeroplane engines. The problem solved was to evolve a simple and reliable workshop method for obtaining thick, hard, adherent deposits of iron on steel mechanism parts which had been overmachined or worn down in a few places, so as to save them from the scrap heap. Existing electrolytic processes chiefly used for refining had to be rejected, for practical reasons; for example, they made use of hot solutions or solutions that could not easily be made up or replaced. Finally, a simple concentrated aqueous solution of ferrous ammonium sulphate was adopted, of acidity not exceeding 0.005 normal, and a current density of nearly 25 amperes per sq. ft. could be reliably employed at normal temperatures to yield hard, smooth, adhesive deposits. From such a solution heated to 65 deg. C., but with 0.02 normal free acid present, reguline deposits could be obtained at 200 amp. per sq. ft. The solutions were found to deteriorate after a few months' use, on account of the accumulation of organic impurities. Boiling expelled these substances and renovated the solutions, but later it was found that the presence of finely-divided wood charcoal in suspension absorbed the organic matter continuously, and prevented the deposition of momentary deposits of hydroxides—the supposed cause of the inferior deposits. The photographs appended to the paper strikingly illustrate the effect of the presence of the charcoal in suspension.

Adhesion to the articles covered was secured either by the common method, of an intermediate copper coating from a hot cyanide bath, or else by thoroughly cleaning the cathodes, either chemically or electrolytically. In the latter case, *i.e.*, direct deposition on to the steel base, heat treatment could be applied to the deposits, and annealing the article and deposit above the A, point (at 950 deg. C.) strongly welded the two together. Subsequent case-hardening and heat treatment gave a surface quite fitted for severe mechanical conditions, and photomicrographs of sections of the deposit showed that the line of demarcation between base and deposit to have been entirely eliminated.

In course of the discussion, it was made clear that the poor mechanical qualities of electro-deposited metals are frequently due to occluded hydrogen. In the case of some metals, *e.g.*, copper "annealing" in an oil-bath at quite a low temperature is sufficient to expel the gas and enormously improve the physical properties of the deposits.

It is clear that a useful future awaits the application of processes like that of Lieut. Macfadyen in the engineering works or repair shop. On this the opinion at the meeting was unanimous.

THE ELECTROLYTIC PRODUCTION OF SODIUM PERCHLORATE.

Sodium perchlorate is now produced commercially by electrolysing the chlorate solution between a platinum anode and an iron cathode. In a paper contributed to Mr. J. GUILFOYLE WILLIAMS, it was stated that better results are obtained at higher temperatures and current densities than those given in the text books. For example, at 60 deg. C. the production of 1 kilo: $NaClO_4$ requires only about 3 kilowatt-hours, as against 3.6 in the accepted practice, and the frequent addition of hydrochloric acid to keep down the alkalinity still further improves the efficiency.

THE MEASUREMENT OF PHYSICAL PROPERTIES AT HIGH TEMPERATURES.

No more difficult problem confronts the practical physicist than the testing of the refractory materials used in furnace construction, and in high-temperature apparatus generally, under the conditions to which they have in practice to stand up. Mr. A. GEORGE TARRANT described to the Society very carefully thought-out pieces of apparatus which he has designed for measuring thermal expansion, conductivity, and tensile strength. For the first of these, the principle adopted is to heat a cylinder 4 in. by ¾ in. diameter of the material under test in a tubular graphite sheath, and measure the expansion of the test piece relative to the tube. The expansion is magnified by the motion of a lever actuated by a long plunger attached to the test piece and extending considerably above the top end of the vertical nichrome-wound electric furnace, which furnishes the source of heat.

For measuring tensile strength, the Harker type of spiral graphite tube furnace was employed, as in this temperatures up to 1,700-1,800 deg. C. were attained. Fig. 1 shows the general character of the apparatus, and indicates the arrangements for clamping and stressing the test piece. The point

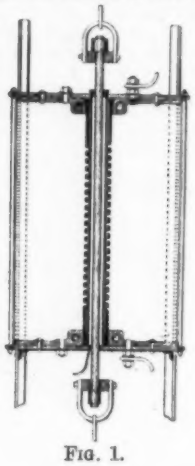


FIG. 1.

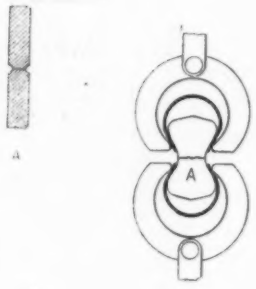


FIG. 2.

of fracture was localised by reducing the diameter of the test piece at the centre, as shown at A. Otherwise the bar was at its weakest and broke outside the hottest zone of the furnace. The simpler device shown in fig. 2 was used for tests at lower temperatures, and this apparatus was of great practical use during the war.

In the measurements of thermal conductivity, the author —as many before him—did not succeed (before the war abruptly terminated his experiments) in obtaining absolute figures that might be of general use. But several ingenious attempts were made, and an electrical and a gas-heating method are described which are well worthy of attention by others engaged on similar measurements. A rough thermoscopic method described was found to suffice for routine works tests.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Technical Books: Some Thoughts and a Suggestion.

That "of making many books there is no end" appears no less true of technical books than of other branches of literature. But the limitation of the time and money of the engineer or student, who desires to learn his profession or to keep in touch with the latest theory or practice, is much more determinate.

When to the host of new books that are poured forth are added reprints (without any additions) of books that were first published many years ago, it seems time that a protest should be made.

On a subject such as electrical engineering, which has made tremendous strides in theory, and perhaps even more in practice, a book published, say, in 1900, is largely out of date, and the mere reprinting of it appears to me to be almost taking advantage of ignorance.

When the date is nowhere mentioned in the book, the student has not even the consolation of *knowing* that he is buying an old book. One would like to see it made compulsory to insert the date of writing, or first publication, in every book.

Then the new (and old) books on any subject overlap one another, and generally endeavour always to start at the elementary theory, wherever they may end, so that the purchaser has to pay for many parts of his reading two or three times over.

Now, my suggestion is that in these days of standardising committees, yet another should be formed representative, say, of the technical institutions, colleges, Press, publishers, and, lastly (but not least), of the gentlemen who write technical books.

These should then agree on suitably graded series of books on the various branches of engineering, one book of a series leading to another more advanced.

They should be produced as cheaply as possible in the first instance, later they would doubtless become so, owing to their larger sale.

Periodically the committees should meet to revise the books, which might be done by adding a supplement from time to time, until sufficient alterations and additions warranted the book being rewritten.

When such a time came, no more reprints of the old one would, of course, be issued.

Thus, for a reasonable outlay, students and engineers could possess a library of technical books, up-to-date, of known contents, and not overlapping.

At present such a thing is quite beyond the purse of the young engineer or student.

A. C. Purday.

London, S.W.
January 10th, 1920.

Theatre Heating by Electricity.

Having had several years' experience in the heating of buildings by steam, hot water, hot air, &c., I found your article in a recent issue of the ELECTRICAL REVIEW on the heating of the Lyric Theatre, Hammersmith, by electric radiators most interesting.

The advantages claimed for the system are great, *i.e.*, low installation cost, reliability, efficiency, simplicity, ease of control, &c., and it will be interesting to learn whether, after a practical test of, say, six months' working, all these advantages, together with low running and maintenance cost, can still be claimed.

In the light of past experience I certainly consider that the electro-steam radiator is the best thing struck yet in the way of electrical heating, but it at once puts it on a par with any ordinary steam-heated radiator, and has all the advantages and disadvantages of the latter. One of the great disadvantages of steam heating is its well-known tendency to burn or dry the heated air to the extent of being quite irritating to the throat; frequently humidifying trays have to be attached to radiators to correct the fault. The electro-steam radiator should, however, enable manufacturers to give some reliable data regarding its heating capacity, such as the transmission of British thermal units per square foot of radiator surface per hour. Such data have hitherto been unprocurable from the manufacturers of electric radiators. Even when the number of B.Th.U. required for the heating of any building is known, it is difficult to decide on the number and size of electric radiators required owing to the lack of reliable data. Assuming that the electric radiators are cheaper to install than a system of hot-water heated radiators, with a coke-fired boiler, there remains the question of running and maintenance costs; the cost of maintenance of the electric radiators will largely depend on the life of the nickel-chrome wire heating elements, which may, or may not, require frequent renewal; the maintenance costs of a hot-water heating apparatus, if carefully installed, will be nil for several years, with the exception perhaps of a few new fire bars for the boiler. It is well to remember also that the hot-water heating does not burn the air in the way that steam and open-element type electric radiators do. As to running costs, it would appear that when all radiators are working at the Lyric Theatre the total energy consumption will be about 40 units hourly. I do not suppose that the hourly B.Th.U. given off by the 37 electric radiators in the Lyric exceeds 200,000; and taking the practical value of coke at 6,000 B.Th.U. per lb. (which is readily obtained with a boiler efficiency of 60 per cent.) we find that 33 lb. of coke would be required hourly for the same B.Th.U., making a total daily coke consumption of 264 lb., or say 2¼ cwt., obviously much cheaper than energy at 2d. per unit; add to the cost of coke an attendant's wages and the daily running cost would still be under £1 per day. In the case of a theatre very little heat will be required when the building is packed with people, as the air readily becomes warm and vitiated, but I venture to state that only a very small proportion of the theatres in the country are steam heated, hot-water heating or warm air systems being largely adopted. Ventilation is usually a difficult problem in the theatre, but for the best results heating and ventilating are inseparable. It is stated that the ventilation at the Lyric is now receiving attention; should this result in an increased air change, then in all probability the energy bill will also be increased. I consider much more will be possible in electric heating in the near future, particularly if the cost of energy comes down to, say, 0.5d. per unit, but before that happens, coal and coke must also come down in price. In the meantime electric radiators may be successfully applied in many instances, especially where intermittent heating will suffice and first cost is a consideration.

J. W. Hitchcock.

January 16th, 1920.

[Most of the data required by our correspondent are given in the article to which he refers. The cheapness of installation is not an assumption; it is a fact. The purchasers informed us that the cost was about *one-third* of that of a hot-water system to give the same results. The coke-fired furnace cannot be started and stopped at pleasure, whereas it is stated in the article that the electric radiators are used for six hours daily, and the efficiency of the latter must in this case be 100 per cent. The price of electrical energy for heating in Hammersmith is 1.5d. per unit with discounts + 25 per cent., and the running cost is stated by the purchaser to be half that of the gas-heating system, which was discarded because it failed to do its work.

On account of the pressure on our space we have been obliged to shorten our correspondent's letter.—EDS. ELEC. REV.]

The Coal Muddle.

As it seems useless to protest to the Government with reference to their idiotic vote-catching "stunts," of which the 10s. rebate is the finishing touch, I suggest that the Electrical and Gas Associations should get together and try "passive resistance" by refusing to claim any rebate or allow any rebate to their consumers. They will save money and an enormous amount of work by doing this. The consumer will, of course, have to pay a trifle more for his electricity and a trifle less in taxation, so that although he will "grouse" he will on the average be no worse off.

Borough Electrical Engineer.

January 17th, 1920.

Awards Delayed.

Being a constant reader and a mechanic, I should like to bring before your notice the reason of much of the discontent of the present day, not always caused by the workmen, but more often by the employers. Holding no brief for either, I believe in square dealing. Why is it that the L.C.C. tramways dilly and dally with red tape and officialdom before paying different sections the awards? It is hard to define, no other employers could approach them. In 1917-18 an award was made to be paid from October. Some got it, others who were justly entitled to it did not until February, 1918, being only paid from then. Why so much letter writing to one official and another? Even the present day awards make practical men tired. These are things that the outside public know nothing of, and it is time so much officialdom was inquired into, as it gives rise to much discontent.

C. R.

A "Live" Lorry.

I was very much amused and interested to see under your heading of "Notes" the account of a "live" lorry at Walsall.

I have a Foden steam wagon under my care, and have experienced similar surprises in the shape of severe shocks upon touching the metal parts after its return from a trip. I may say I too was somewhat puzzled until one day the boiler inspector happened to be making one of his calls. Before going too near he asked where the "safety chain" was.

Noticing that I did not quite understand his meaning, he explained the necessity of having attached to the metal underframe a small piece of chain which would trail along the ground, and by so doing relieve any person from nasty shocks which he had experienced only too often.

It must be explained that this only applies to those wagons which have rubber tires. I take it that the entire wagon is insulated from the ground, and that a static charge is generated by the constant blowing-off of steam from the safety valve, as no matter what one might tell these drivers, they always like to see that "blow" going on; they know they have "a little to spare," as they put it.

It would be interesting to know whether the Walsall Foden was rubber-tired; if so, was the safety chain in order—or lost—on that particular trip? It has a knack of leaving itself on the road, through wear.

J. G. Paterson.

Warlingham, Surrey.
January 19th, 1920.

With reference to your note in the last issue on a steam wagon becoming charged with electricity whilst standing in the roadway. I once heard of a similar occurrence, but in this case the explanation given was that the friction of the steam issuing from the safety valve had caused the metal parts of the vehicle to become charged with static electricity, and as the wagon was mounted on rubber-tired wheels, the charge could not escape to earth, hence any person touching the engine would receive a shock.

Stuart F. Philpott.

Birmingham.
January 19th, 1920.

The Marconi International Code.

Having had some years' experience of both using and constructing telegraphic codes, I read with much interest "C. H. C.'s" able review of the "Marconi International Code" (THE ELECTRICAL REVIEW of December 26th, 1919).

It would appear that "C. H. C." was very favourably impressed with the greater part of the code, but is not so enthusiastic as regards the "Numerical System."

It is agreed by all who use codes that the three principal ends for which the compiler of a code should strive are:—

(*a*) Economy in transmission.
(*b*) Simplicity and rapidity of use.
(*c*) Safety in transmission.

Re (*a*), the compilers of the code claim to effect considerable economy over existing codes, and "C. H. C." in this connection only remarks that "A check which has to be worked out for each code word not only adds complications and increases the work of coding and de-coding, but decreases economy to the extent of the check syllable. As regards the last portion, surely "C. H. C." has overlooked the fact that the final syllable in the system under criticism, in addition to acting as a check, can be made to convey any one of 23 separate meanings which are in frequent use, *e.g.*, "C.I.F.," "F.O.B.," "for immediate shipment," "60 days' sight," &c. This I believe to be an entirely new departure in codes, and it will consequently be seen that C. H. C.'s remark (a little lower down in his review) that, "The fifth syllable then confirms this check figure in the usual manner," although in a way true, hardly does justice to the code. As regards the question of complications and increased work in coding (see also (*b*) above), with the expenditure (once and for all) of a very few minutes' preliminary study of the tables and explanations, the use of the numeral system becomes not only a very simple matter, but quicker in actual use and appreciably more economical than any other code I know.

Under heading (*c*) comes "C. H. C.'s" principal alleged weakness.

In theory, the more usual mutilations which occur in transit should be "caused by the omission, the addition, or the changing of a Morse dot or dash," but my own experience and that of many other users of codes with whom I have discussed the matter on frequent occasions, has satisfied me that in only a small percentage of cases is an error in transmission due to one of these causes. Possibly this is due to telegraphists being carefully trained and warned against these obvious errors. Many codes contain voluminous tables showing the probable mutilations of single letters and two-letter syllables, but I have yet to meet any de-coder who has ever really profited by them.

If absolute safety in transmitting figures is essential, then the entire telegram can be repeated (*i.e.*, sent twice) automatically; the cable companies charge only quarter rates for such repetition, and even if every message were so repeated there would still be an appreciable saving in cost in comparison with employing most existing codes, as well as a large saving in time of both coding and de-coding. In practice, however, it would meet all possible contingencies if the single code word which conveys the numerals were itself sent twice over in the original telegram.

It is a little difficult to grasp what is "C. H. C.'s" attitude towards "checks." In one place he falls foul of the use of a check, whilst in another he apparently holds up as an ideal some code which employs "a simple double check."

On the whole, I deduce that "C. H. C." is drawing a comparison between the numerical system of the Marconi code and an ideal (but as yet unattainable) perfect system, and not between the Marconi and any existing code. Taking the ideals to be aimed at in a code as economy, rapidity, and safety, it is an easy matter to produce a code which is practically perfect under one of these headings; a fair approximation to perfection can be obtained by devoting attention to two only and ignoring the third; but for all normal work in which all three factors have necessarily to be taken into consideration, the Marconi code is, in my opinion, far ahead of all existing codes, and has the further great commercial advantages of rendering the telegram equally intelligible in nine languages, and of employment also for conducting and translating foreign correspondence.

Code Enthusiast.

January 13th, 1920.

[We regret that we have been compelled to shorten this letter considerably.—EDS. ELEC. REV.]

The "Lesco" Lampholder.

Without wishing to enter into any controversy or express an opinion on the merits or otherwise of the above lampholder, there is a statement in Mr. Hope's letter in your issue of January 16th, that interests us. He says "There is more metal in the Lesco holder than in the best quality English holders."

The complete brass case of our Cordgrip lampholder is half an ounce heavier than the "Lesco."

For **J. H. Tucker & Co., Ltd.,**
W. J. LINE,
Chief of Technical and Design Department.

Birmingham, *January 17th*, 1920.

My attention has been drawn to Mr. Turnbull's letter to the ELECTRICAL REVIEW regarding the above, and, being the patentee of another lamp holder, I would like the opportunity of making it clear to your readers that although some of the features in my holder (the "Scot" lamp holder) appear to have been followed in the "Lesco" lamp holder, the defects pointed out by Mr. Turnbull do not exist in the "Scot" holder, the barrel of which is in one piece.

My patents were granted between February, 1917, and May, 1919, between which dates Mr. Vernon Hope and others (the promoters of Lesco, Ltd.) entered into prolonged negotiations with me for a licence to enable them to construct lamp holders under my patents. These negotiations were,

however, broken off by the said promoters towards the end of May, 1919, and a few weeks later provisional patents, under which the "Lesco" holder is manufactured, were applied for by Mr. Hope.

I write in order to avoid the possibility of any confusion between the "Lesco" and the "Scot" lamp holder, and I will be pleased to send a sample of the latter holder to anyone interested.

A. Peden Rutherford.

Leith.
January 12th, 1920.

We read with interest the correspondence regarding the "Lesco" holder, which no doubt is ingenious. We do not think there is anything against the weight-carrying parts, as the indentations should carry any shade intended for the ordinary C.G.S.C. holder.

As regards the corrosion which Mr. Turnbull quotes, this is liable to happen to any metal holder, and if these are overlooked in damp positions, one can only expect falling shades, &c. A little grease and attention will remedy this point.

Now we come to the interior, and from the sample supplied to us we find that the contacts being on the one spring do not adapt themselves to the lamp contacts, as is the case with the ordinary holder, in which the separate plungers will make contact with any uneven contacts of the lamp. If the Lesco holder had these plungers we think it would be an advantage.

Ardwick, Manchester, **H. Wogan & Co.**
January 17th, 1920.

LEGAL.

HODGES *v.* WEBB.

[THE E.T.U. AND THE N.A.S.E.]

(Continued from p. 76.)

FURTHER evidence was given on Tuesday, January 13th, the cross-examination of Mr. Tyler being continued by Mr. Cunliffe, K.C. He said that the E.T.U. would not accept the code of rules arranged by his society, and the men went out on strike. That was in 1914.

Mr. BANISTER, the hon. secretary of the N.A.S.E., was the next witness called, and in the course of his examination by Mr. Hughes, said that the N.A.S.E. was not formed with a view to interfering in trade disputes, but it became a trade union in 1918, since which period it had power to take part in trade disputes. The Society had 17 hon. members, five of whom were contractors, but they were not allowed to attend any of the meetings except the educational lectures.

In cross-examination by Mr. CUNLIFFE, witness said that the N.A.S.E. did not support the masters in 1914. It was not then a trade union.

The plaintiff next gave evidence generally bearing on the counsel's opening statement in regard to the occurrences on October 13th. Until then, he said, there had been no dispute and no complaints had been made by the men.

In cross-examination, the witness said that when he went to Watford on the job, he asked one of the Watford men whether Watford was in the London district, and what were the local rates, and the man to whom he had spoken wrote them down on a slip of paper and handed them to him. He had not seen the defendant before October 13th, and there was no reason why the defendant should have any ill feeling against him.

Mr. CUNLIFFE, in opening the defendant's case, submitted that there was nothing for him to answer. The right of a man to dispose of his labour as he pleased was merely the correlative right of other men to dispose of their labour as they pleased, and there was nothing to prevent their refusing to work with other men, if they so desired. The words alleged to have been used by the defendant, if they were used, were merely a statement that the plaintiff would lose his livelihood, and there was no threat. It was, said counsel, obvious that the N.A.S.E. if not really a masters' union was protecting the interests of the masters. Men had a perfect right to refuse to work with non-unionists, and the defendant was entitled to do as he had done, even if there had never been any dispute as to working hours.

The defendant, in the course of his evidence, said that the first he had heard of any dispute at Delectaland was when a deputation came from the Watford branch to the London District Council and made complaints. They made three complaints about the terms on which Messrs. Tyler & Freeman's men were employed. When he went to Delectaland on October 13th he had a talk with the men before he saw Hodges, and they joined the E.T.U. When Hodges came down he (defendant) asked him whether he was a member of the E.T.U., and he said that he was not, but that he was a member of the N.A.S.E. He (witness) thereupon pointed out to him that the N.A.S.E. was not a recognised trade union, and asked him to join the E.T.U., which he declined to do. Upon that he (witness) went back to the other men, and told them that Hodges had refused to join the E.T.U., and that under the circumstances he had no option but to call them out.

On January 14th the defendant was further examined in chief, and in reply to counsel, said it was untrue that he adopted a dictatorial attitude or endeavoured to intimidate Mr. Hodges. Nor did he shake his finger in Hodges's face. He might, however, have made an "oratorical" gesture. He tried to persuade him to join the E.T.U., and so avoid further trouble, and he did tell him that if he was not prepared to join he (defendant) would have no option but to withdraw the union members from the job. He had never seen or heard of Hodges before, and bore him no animosity. He was sent to Watford to investigate complaints as to the employment of non-unionists, as to hours, and rates of pay, and to try and make peace. There were over 50,000 members of the E.T.U., and he could fill a book with reasons why the E.T.U. could not recognise the N.A.S.E.

In cross-examination by Mr. HUGHES, defendant said that he did not tell the plaintiff that he would have to get off the job unless he joined the E.T.U., but he did explain that his refusal to join might result in his having to leave the job. He told the man "not to be an ass." Plaintiff said that he had an old E.T.U. ticket at home, and on being asked why he had joined he replied "Compulsion." He was not in the habit of using the expression to men who refused to join the E.T.U.—"I'll take away your livelihood."

Counsel read a letter from the witness to a foreman named Branscombe, who had signified his intention of leaving the E.T.U., asking him to reconsider his decision, and stating that if he persisted in leaving the union he would placard his name throughout the districts telling all members of the union to refuse to obey his orders as foreman. He also wrote that is the event of refusal to rejoin he would wherever possible hound him from the trade.

The hearing was continued on January 15th.

Mr. WEBB, in further cross-examination, said he had the power to call out E.T.U. men from jobs where N.A.S.E. men were employed. If Mr. Hodges had consented to join the E.T.U. the other matters at issue could have been discussed.

Witness, in reply to a question by the judge, said he was prepared to admit frankly that if the plaintiff joined another firm and still refused to become a member of the E.T.U. the workers belonging to that union would be withdrawn from any job on which the plaintiff was working.

Evidence was then given as to discontent alleged to have prevailed amongst the men working at Delectaland, and with that the case for the defence closed.

Mr. CUNLIFFE, K.C., addressing the Court on the whole of the evidence, said that in the action there had been a determined and deliberate challenge of the rights of trade unionists to refuse to work with non-unionists. This challenge went to the root not merely of trade union rights and privileges, but also of the rights of every free man in the country. If the action succeeded it would, he contended, be impossible for any trade unionist, or indeed for any man or woman, to refuse to work with any other man or woman without exposing himself or herself to litigation of this kind. The allegation of coercing the employers reminded him, said counsel, of the Irish landlord, who, on his attention being called to a threat by Fenians to shoot his agent, remarked "If these people imagine they can intimidate me by shooting my agent, they are mistaken." He submitted that it was not unreasonable for workmen to object to work with members of the National Association of Supervising Electricians, an association which consisted of managers, and had as honorary members masters pure and simple. The E.T.U. refused to recognise Mr. Hodges's society as a genuine workmen's society. They regarded it as a society which was seeking federation with the E.T.U., when it was in point of fact a satellite of the Masters' Association. At the time of the trouble at Watford there had been an active and continuing dispute as to the working hours and rates of pay, as well as in regard to working with non-unionists. The latter was the chief question with which the Court was concerned, and he contended that the defendant was rightly justified in what he had done.

Counsel then proceeded to deal at length with the various authorities recording decisions bearing upon the point in question, and argued that his Lordship had to decide whether there had or had not been a trade dispute within the meaning of the provisions of the Act of 1906. It would, he said, be enough if it had only been a dispute as to the employment of trade unionists. But it went further than that, as a meeting had been called to decide whether unionists should be compelled to work with non-unionists. It was a dispute in regard to the particular class of individuals of whom Hodges was one.

His LORDSHIP said that the dispute referred to in the Act meant that there must be a dispute with the employers, but in this case there was no dispute between Mr. Tyler and the union, because at the time of Mr. Webb's visit they had not approached each other.

Mr. CUNLIFFE said that there was a dispute immediately the strike was called. There was a controversy going on as to whether unionists should be compelled to work with non-unionists, and everyone knew about it. It was not essential that there should be a strike or even a dispute at a particular place. His submission was that the dispute was not only a dispute between employers and workers, but a dispute between workmen and workmen, inasmuch as it was a dispute between members of the E.T.U. and the N.A.S.E. The Act was undoubtedly intended to give the widest conditions of

protest to workpeople as to the terms of their employment, and the question was whether compelling a man to work with a non-unionist was a condition of employment contemplated by the Act. He contended that the dispute that was going on at the Watford works was a trade dispute within the meaning of the Act. It could not be said that defendant was coercing the masters by what he had done, as when he went to Watford there was undoubtedly a dispute going on between Mr. Tyler and his men. Whatever test was to be applied, whether it was a test of there being a broad and general dispute as to the working with non-unionists, or a dispute as to the working of the E.T.U. with the N.A.S.E., it was enough for his purpose if he was able to establish that there was a dispute going on between the masters and men, and it was impossible to say that what Mr. Webb had done was not an act done in furtherance of a dispute existing at the time. It was said that he had done something which interfered with the right of the plaintiff to dispose of his labour as he willed.

His LORDSHIP: An interference with his employment.

Mr. Cunliffe said that both meant the same thing, but there really was no interference with his employment, as Mr. Tyler was entitled to give him notice, and he did so.

His LORDSHIP: Supposing a man induces an employer to break a contract of employment by means of a threat to shoot him if he does not do so, would that come within the Act and not be actionable?

Mr. CUNLIFFE said that so far as the threat to shoot was concerned he could get an injunction, but not because the object was to bring about a breach of contract. The man could be punished for threatening. As a criminal offence he could be brought before a Criminal Court, but so far as the civil remedy was concerned the Court might be asked for an injunction to restrain the man from repeating the threat. His submission was that the act of the defendant was in furtherance of a trade dispute, and that no action could be brought.

At the conclusion of the learned counsel's speech, which had occupied two days, the hearing was adjourned.

The hearing was continued on Monday and Tuesday, when counsel for Mr. Hodges summed up the plaintiff's case on the facts and the law. He (Mr. Purchase, in the absence of Mr. Hughes, K.C.) argued that if the case were decided against the plaintiff it would put an end to all liberty of action on the part of workmen, who would simply be as putty in the hands of a secretary of a powerful trade union. He denied the suggestion of Mr. Cunliffe, on behalf of the defendant, that the N.A.S.E. was not a genuine workmen's trade union but a masters' union. The evidence, he said, showed that it was not a masters' union. As to the allegation of the existence of a trade dispute, he argued that in face of Mr. Tyler's evidence that in other works in which he was engaged there were N.A.S.E. working with E.T.U. men, it could not be said that there was an active dispute in existence on the question whether N.A.S.E. and E.T.U. men should work together. The plaintiff, he said, had a common law right to dispose of his labour as he pleased, and he submitted that the defendant had interfered with him in that right, and that he had suffered loss in consequence. What the defendant had done was actionable before the passing of the Trade Disputes Act, and that Act did not protect him now. There was no evidence in this case that there was a trade dispute within the meaning of Section 3 of the Act, and even if there had been there was no evidence that what was done had been done in furtherance of the dispute. In conclusion, he characterised the action of the defendant as a "malicious vendetta" against the plaintiff, because he refused to renounce his rights and privileges in the N.A.S.E. and join the E.T.U., and said that defendant by calling out the employés had coerced the employers.

His Lordship reserved judgment.

PROSECUTION UNDER THE FACTORY ACTS.

AT Glasgow on January 15th, Grindley, Ross & Co., Ltd., electrical engineers, Bridgeton, Glasgow, were charged at the instance of Mr. W. D. Kirkwood, H.M. Inspector of Factories, with having failed to efficiently protect electric wires used for lighting supply in the premises of James Allan, Senior & Sons, Ltd., Lambhill Iron Works, Glasgow, in consequence of which John McKay, 16 years of age, was killed on August 13th last. A plea of "Not guilty" was tendered. From the evidence submitted it appeared that a temporary installation had been carried out to give light to two punching machines. Owing to the presence of a crane, overhead lighting was not feasible, and the respondents' electrician placed the cable on the ground between the machines. The voltage was, roughly 240 A.C. On August 13th McKay, while walking to one of the machines, stepped on to some iron plates which were on top of the electric wire and received a shock from which he died. Two other workers also sustained shocks, one of them being thrown off his feet and rendered insensible for a time.

The respondents' representative stated that after the accident occurred he disapproved of the way the job had been done. The wire should have been overhead or laid in conduits underground. Had he known how it was placed he would have had the wire removed. Whether temporary or permanent, it was dangerous.

For the respondents, an agent argued that the firm having employed a journeyman electrician on the work the fault did not lie with them. Their employé had no authority to break the regulations.

The SHERIFF expressed sympathy with this view, but said the mere fact that respondents chose to perform their contract through a workman would not relieve them of responsibility. The fault was entirely with their employé, who had betrayed an utter recklessness of the lives of fellow workmen. So far as the respondents were concerned, their's was a technical offence. He imposed on them a fine of £15, with £5 expenses.

BRITISH INDUSTRIES, LTD. v. SIMPSON.

IN the King's Bench Division, on January 16th, plaintiffs, of Wandle Bank, Wimbledon, brought an action before Mr. Justice Rowlatt to recover the sum of £141 17s. 9d. for dry batteries and torches sold and delivered to Mr. Ralph Darlington Simpson, of Leadenhall Street, under contract during August and November, 1918. Defendant's case was that the plaintiffs failed to perform their contract to deliver batteries with the cases, and he counter-claimed for £299 odd as damages. The evidence was mainly directed to the question of accounts between the parties, and his LORDSHIP, in giving judgment, said the case really fell into two parts arising mainly out of the counter-claim. One of the items was for the non-delivery of 2,000 bull dog torches and refills, and it was quite clear defendant was entitled to some damages for that, as there was a profit to be made on these things. He thought the defendant had been very hardly treated, as he got cases but could not get batteries for them, and therefore suffered serious loss. He had to make guess at the damage suffered, but the result of his judgment was that plaintiff was entitled to £133 9s. 9d. on the claim, and defendant must have judgment entered for him on the counter-claim for £150.

GRAHAM v. HOLME ELECTRIC LIGHTING CO.

AT the Holmfirth County Court, on January 14th, Messrs. J. W. & R. Graham, electrical engineers, Huddersfield, sought to claim from the Holme Electric Lighting Co. for work done in connection with the company's electricity undertaking, and there was a counter-claim by the company for £36 15s. for breach of contract. Messrs. Graham alleged that they had carried out certain work in connection with the installation of electric lighting at a village near to Holmfirth, where the plant is driven by water power. This work was not in the contract.

The Holme Electric Lighting Co., in their counter-claim for breach of contract, alleged that the plaintiff company had not carried out their contract. Messrs. Graham denied liability, and paid a certain sum into court. Defendants contended that they had been relieved of certain work by the chairman of the company.

His HONOUR, in giving judgment, found for the plaintiffs for £1 11s., in addition to the £37 6s. 8d. which they had paid into court, and disallowed the counter-claim.

BRITISH THOMSON-HOUSTON CO., LTD. v. CORONA LAMP WORKS.

THIS case, in which plaintiffs ask for an injunction restraining defendants from infringing Letters Patent No. 10,918, and asking for damages or an account of profits and delivery up of any infringing articles, was commenced before Mr. Justice Sargant in the Chancery Division on Tuesday. The defence was a denial of infringement.

French Railway Conversion.—A few months ago we referred to the return to France of a Technical Committee dispatched by the French Government to the United States, in order to study the systems of electric railway working in that country. The Committee reached the definite conclusion that the direct-current method at 2,400 volts was the most suitable for adoption on the different railway systems in France. In this connection M. Mauduit, who was one of the Committee, recently delivered a lecture on the subject before the Société Industrielle de l'Est. He is reported to have stated that the 2,400,000,000 KW.-hours, which in 20 years will represent the energy necessary for the working of the electrified railways, would replace 4,000,000 tons of coal per annum. The total length of the lines to be converted to electric traction was 5,480 miles, of which 4,992 miles were in operation, 218 miles in course of construction, and 270 miles projected.

Power Station Wages at Johannesburg.—According to a Johannesburg report appearing in the *Cape Times* for December 18th, a demand for £9 17s. 4d. per week was being considered by the artisans at the power station in place of £8 2s., and it was hoped to gain the support of all branches of the municipal service in order to make this amount apply all round. "It is said that a little uneasiness prevails in committee circles over the proposed demand. The municipal employés have been told that if it is insisted upon the town's finances will not be able to bear the strain. Indeed, it is asserted that they have been warned that if such a demand is made, the Labour Party will resign on the plea that it cannot carry on under such increased financial responsibility, inasmuch as it will not be able to meet the pledges given to the ratepayers."

BUSINESS NOTES.

The Moulders' Strike. — The moulders are taking another ballot this week. The result may be announced before this issue is in print.

Travelling Exhibitions for Overseas Trade.—In a recent speech, Sir Hamar Greenwood referred to a scheme that the Department of Overseas Trade was preparing for touring exhibitions. The *Board of Trade Journal* now gives some particulars. The tour is being organised to exploit the present splendid markets for United Kingdom goods in the great overseas Dominions. It is designed to be the cheapest and most comprehensive vehicle for the display of Home products. Samples will be packed and carried in specially designed show-cases and exhibitions erected in the industrial cities of the Empire. The Dominions Governments have promised all possible support, and all the Chambers of Commerce consulted have expressed the conviction that the tour will be a success. The proposed itinerary and approximate time-table (leaving the United Kingdom, May 1st, 1920), is as follows :—

City.	Arrive.	Depart.
Durban	May 21st, 1920.	July 12th, 1920.
Johannesburg	July 14th, 1920.	September 11th, 1920.
Cape Town	September 14th, 1920.	November 12th, 1920.
Perth	December 3rd, 1920.	January 21st, 1921.
Adelaide	January 25th, 1921.	March 22nd, 1921.
Melbourne	March 23rd, 1921.	May 18th, 1921.
Hobart	May 20th, 1921.	July 1st, 1921.
Brisbane	July 7th, 1921.	September 1st, 1921.
Sydney	September 2nd, 1921.	October 28th, 1921.
Christchurch	November 2nd, 1921.	December 28th, 1921.
Auckland	December 31st, 1921.	February 25th, 1922.
Vancouver	March 18th, 1922.	May 13th, 1922.
Winnipeg	May 16th, 1922.	July 11th, 1922.
Toronto	July 14th, 1922.	September 8th, 1922.
Montreal	September 8th, 1922.	November 4th, 1922.
Halifax	November 6th, 1922.	December 25th, 1922.

Arriving in Liverpool in January, 1923.

The aim of the Department of Overseas Trade will be to make the tour self-supporting, the exhibitor having to pay simply for the cost of freight, rents, and show-cases. Estimating on a basis of 500 exhibitors, the tour can be run under present conditions at a maximum cost of £200 per firm or unit. A half-unit would cost £120. Should the surplus allow, the tour might be extended to the West Indies, or the balance refunded to the exhibiting firms. In conjunction with the actual samples, it is designed to tour cinematograph films showing an extensive field of British productions, especially in the heavier goods, which are too expensive to tour by sample.

We are informed that the regulations and conditions relating to the tour will be published in pamphlet form, and will be obtainable from the Intelligence Stall at the British Industries Fair, or subsequently from the Department of Overseas Trade.

Women in Engineering Works.—*The Times* states that some 5,000 firms in Great Britain have been asked by the Women's Industrial League for a statement of their experience of women as industrial workers. Over 1,400 replies have been received, covering a wide field in engineering and other trades. In the main they may be regarded as satisfactory by a league whose object is to secure equal opportunity for employment in all occupations to men and women. The replies, as scheduled, show that 1,422 firms were employing 79,700 women at the end of May, 1919, as compared with 43,200 before the war and 245,300 during the war. Of 382 firms who employed women before the war, 67 propose to increase the number, in consequence of the larger experience of women's work gained by them; while of 764 who employed women for the first time during the war, 228 proposed to retain them. These firms do not comment on the present labour situation. A further 97 firms state that they would be willing to retain women but for Trade Union opposition. Taking all the figures, the estimate is that over 60 per cent. of those who have tested women's work are ready to continue employing them. Nor, for various reasons, must it be assumed that the remaining firms are necessarily unwilling to use women's labour.

The Packing of Machinery for South America.—A mechanical engineer with many years of experience on the West Coast of South America has given H.M. Commercial Secretary at Lima the following note on the packing of machinery, particularly electrical machinery, for South America :—

"All engineering plant should be packed in strong, braced, open cradles of deal, and these cradles should again be packed in a heavy deal packing case, fitted with battens and, if possible, with diagonal braces. Machines must, under no circumstances, be bolted down to one side of the case. There is no objection, however, if the opposite side of the machine is bolted to the case, too. It is much better, however, to pack the goods in a cradle and to make the cradle fit the case exactly, so that, even if the case is dropped, the stress is distributed equally all over the case, and not on any one side or end.

"All such small fittings and projections as handles, levers, valves, pressure gauges, &c., should be detached and packed tightly with wood wool into a small strong wooden box, firmly screwed on to the inside of the main case or cradle. Any moving parts (as armatures of electric motors) must be wedged tight relatively to the fixed portion, to prevent oil rings being sheared off, bearing shields broken, and other damage occurring.

"Any case containing machinery should be capable of being dropped 15 times from a height of one metre on to a concrete floor without injury to case or contents. This represents the average history of a case of machinery leaving England or America, and arriving on site at final destination. So few breakages have occurred with this system of packing over a large number of consignments that insurance against it is not really necessary. The cost of the packing is 30 per cent. above that of ordinary heavy cases."

A sketch illustrative of the above instruction may be seen on application to the Latin America Section of the Department of Overseas Trade.—*Board of Trade Journal.*

Bankruptcy Court Appointments.—Consequent upon the appointment of Mr. E. S. Grey, Senior Official Receiver attached to the High Court in Bankruptcy, to be Controller of the Clearing Office for Enemy Debts, the President of the Board of Trade has appointed Mr. W. P. Bowyer to be Senior Official Receiver, Mr. D. Williams, hitherto Senior Assistant Official Receiver, to be Official Receiver, and Mr. F. T. Garton, Assistant Official Receiver, to be Senior Assistant Official Receiver.

Charges of Stealing.—At Leeds, on January 13th, the charges against V. W. T. Bradshaw, of Sunderland, for the alleged theft of electrical appliances from the Barnbow Filling Factory, near Leeds, and G. E. Pearson, of Pearson & Sons, Ltd., Farsley, for an alleged like offence as bailee, were again investigated. Pearson was committed for trial at the Assizes on the charge of stealing an electric motor, and on the other charges he and Bradshaw were further remanded, bail being allowed.

Horace Collins (26), an electrician and demobilised soldier, Pendlebury, was at Manchester County Police Court, on Saturday, charged with stealing from Messrs. J. Gerrard & Sons, Ltd., builders and contractors, of Pendlebury, some time between December 11th and 18th last, eight electric lamps and four electric switches, valued at £4 12s. Defendant, it was stated, had been employed as an electrician by the prosecutors for two months, and in the course of this work had access to the storeroom. With the property he had stolen, it was alleged that he had entered into a contract to fix electric fittings in the Unitarian schools at Pendlebury, which he did. Defendant, who pleaded guilty, said the reason he did it was to augment his money, as he could not follow his work regularly. Collins was fined £5.

George Davies, electrician, of Kilmarnock, has been sent to prison for three months for the theft of three watches and a diamond ring from a shop where he had been sent by his employer to do some repairs.

The E.D.A.—We have received a quantity of advertising matter recently published by the ELECTRICAL DEVELOPMENT ASSOCIATION, Hampden House, 84, Kingsway, W.C. 2. These latest indications of the Association's activities present many interesting features. The chief aim of this form of propaganda is to educate the non-technical public up to a proper appreciation of the value of electricity in the home. For instance, one of the leaflets ("Fuel Waste : the Remedy") graphically illustrates the inconvenience and discomforts of the use of coal in the home, and favourably compares the cleanliness, cheapness and convenience of an electrical installation. This pamphlet also illustrates the work done in various ways by a unit of electrical energy, stating, for instance, that the unit will drive a fan for 10 hours or illuminate a 25 C.P. lamp for 30 hours. Another leaflet ("Where Light means Business") depicts by means of actual photographs the correct and incorrect methods of shop-lighting. The efforts of the E.D.A. should go far to popularise electricity and increase the sale of appliances.

Industrial Problems.—A series of lectures dealing with Industrial Problems is to be delivered at the Carpenters' Hall, Throgmorton Avenue, under the auspices of the Industrial League and Council. Sir George Paish, financial expert, has promised to give a lecture, almost as soon as he returns from America, on "A Defence of Capitalism." "The Industrial Situation" is the title of an address to be given by The Rt. Hon. W. Adamson, M.P.; Mr. G. J. Wardle, C.H., M.P., Parliamentary Secretary to the Minister of Labour, will give an address on "Industrial Unrest and Whitley Councils," and Mr. T. E. Naylor will lecture on "Trade Unionism and Output."

Board of Trade.—The Board of Trade announce that the Scientific Instruments, Glassware, and Potash Production Branch, and the Mineral Resources Development Department, have now removed from 7, Seamore Place, Curzon Street, W. 1, to the new public offices, Great George Street, S.W. 1 (Telephone number, Victoria 9800). The office of the Controller of Trading Accounts has also removed to Great George Street from Gwydyr House Annexe, Whitehall, S.W. 1.

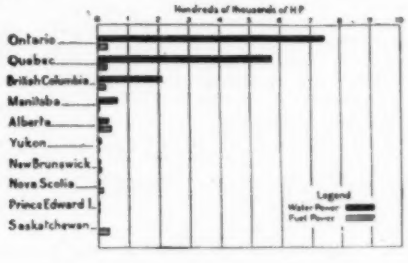
Edison Swan Electric Co. and Philips's Lamp Works.—The Edison Swan Electric Co., Ltd., announces that Dr. G. L. F. Philips and Mr. A. F. Philips, of Philips Glowlamp Works, Ltd., Eindhoven, Holland, have joined the board of directors of the company.

The *Financier* stated, on the 17th inst., that an important Dutch firm "which possesses a monopoly in the manufacture of a particular kind of half-watt lamps" had acquired approximately one-eighth of the issued capital in the Edison Swan Co., and that the latter would acquire the sole rights of sale and manufacture in Great Britain of the lamp referred to.

Copper and Lead Prices.—MESSRS. JAMES AND SHAKESPEARE report January 21st, English pig lead £48 5s., a reduction of 5s. No changes are reported in copper.

Strike in Swedish Engineering Industry.—A Reuter dispatch from Stockholm stated that the efforts to end the disastrous strike in the Swedish engineering industry had not yet been successful. On the 16th inst. the arbitrator in the dispute informed representatives of the employers and the strikers, that at present he was unable to submit a proposal suitable for mediation. He also informed the Government of this fact, and suggested that the Government should appoint a special committee to continue his efforts to bring about a settlement. Subsequently, representatives of both parties to the dispute conferred with the Minister of the Interior, who had expressed a desire to learn the real facts of the case with regard to the strike. Nine thousand more workmen at various factories were on strike, as were also the electrical fitters.

Book Notices.—"Central Electric Stations in Canada, Part I—Statistics." 74 pp. Price 10 cents. Canada: Dominion Bureau of Statistics.—This interesting publication, compiled from statistics obtained by the Census of Industry, 1917, presents fully the state of the Canadian electrical industry as far as the generation of power by central stations is concerned. Reports were received from 666 central stations, 196 of which were purchasers and sub-distributors of energy. The whole of the volume clearly illustrates the overwhelming preponderance of hydro-electrical generating stations which produced 89·6 per cent. of the total generated. The number of generating sets reported was 983, developing an aggregate of 1,844,571 H.P. Of these totals, it is shown that 619 were operated hydraulically, and developed 1,652,661 H.P., 251 were steam-driven units with a capacity of 180,200 H.P., while the remaining 113, producing 11,710 H.P., were gas and oil engines. The Province of Ontario employs water-power in the development of no less than 95·7 per cent. of its total energy, which in 1917 was 604,024 K.V.A. Yukon, chiefly on account of the power used in



mining, showed a larger percentage still—97·4. Quebec and British Columbia show percentages of hydraulic production to totals of 94·9 and 89·8 respectively. Saskatchewan, consisting for the greater part of prairie land, possesses no hydro-electric central stations. A graphic illustration of the position occupied by hydro-electric plant is reproduced from the report (fig. 1). The statistics relating to steam-driven plant show that turbines are generally used, the proportion of reciprocating engines being very small. The amount of coal of all descriptions consumed during 1917 is given as 448,200 tons; coke, 46,370 tons. The oil consumption was 17,529 gallons. The financial statistics indicate that a total of $356,004,168 represents the capital invested in lands, buildings, and machinery, up to the end of 1917. Revenue from the sale of energy is given as $44,536,848. The total of the wage-bills of all the concerns was $7,777,715—the number of employés of all classes being 8,847, which represents an average per employé of a trifle over $879. Among the facts mentioned in the report, it is calculated that there was 221 H.P. of generating plant per 1,000 population throughout the Dominion at the end of 1917. Part II, a separate publication, is a directory of the Canadian power undertakings, issued by the Department of the Interior (252 pp., and map), giving complete details of the stations summarised in Part I.

"Overhead Electric Power Transmission Lines." 80 pp. 10s. 6d. net. Johnson & Phillips, Charlton, S.E. 7.—This work, printed on art paper and well illustrated, describes in detail methods of deciding routes for overhead transmission lines, and calculating quantities and strength (electrical and mechanical) of the necessary materials. The first few pages are devoted to extracts from Board of Trade Regulations governing the erection and maintenance of overhead lines, and also notes for the guidance of applicants for consent to the erection of such lines. Subsequent sections deal with:—(i) Conductors—their size, strength, and properties; (ii) Poles—wooden, steel, and ferro-concrete; (iii) Insulators—giving a table of dimensions and "spark-over" voltages, and also dealing with terminal boxes; (iv) Guarding—various methods of protecting lines and persons; (v) Line disturbances and protective devices; (vi) Telephone wires on power lines; and, finally a small note on switchgear, transformers, &c.

"The Power Facilities of Sheffield." 27 pp.—A booklet issued by the Development Committee of the Sheffield City Council as one of its series of pamphlets giving information about the city's industries and developments. Details are given of the power undertaking, and among the many illustrations are reproductions of several that appeared in our columns in January, 1919, when we published a descriptive article of the Sheffield plant.

"The Dyeing Industry" (third edition of "Dyeing in Germany and America"). By S. H. Higgins, M.Sc. 189 + 22 pp. Price 8s. 6d. net. London: Longmans, Green & Co.—The original edition of this work appeared in 1907. It is devoted to a survey of the industry, and gives details of the many processes involved. The book has been brought up to date by the addition of a chapter on the progress made during the war period.

"The Turret Lathe and Its Work." 46 pp. Alfred Herbert, Ltd., Coventry.—This is a profusely-illustrated production describing various classes of work which can be performed on turret and capstan lathes. The examples given are chiefly aero engine parts, cylinders, crank-cases, crank-shafts, &c. Space is also afforded to a description of an automatic turret lathe, which stops upon the completion of a cycle. Messrs. Herbert state that a copy of this publication will be sent post free to anyone interested in the subject.

"The Electrical Engineer's Diary, 1920." 474 pp. and diary. 7s. 6d. post free. London: S. Davis & Co., 30 and 31, St. Swithin's Lane, E.C.—The twelfth annual issue of this valuable publication has been thoroughly revised and brought up to date, especially the list of British electrical undertakings. Two new sections have been added, dealing with electric motor control, and the installation and maintenance of cables.

"British Trade with Brazil." Hints for manufacturers and exporters. Compiled and issued by authority of the British Chamber of Commerce, of Brazil (Inc.), by Arthur Abbott, secretary, March, 1919. Second edition. Rio de Janeiro: 51-53, Avenida Rio Branco.

Manchester Steam Users' Association. Memorandum by Chief Engineer (Mr. C. E. Stromeyer), for the year 1918-19.

"The Ericsson Review." January, 1920. 20 + vii. pp., 3d. net. A magazine for the employés and friends of the British L.M. Ericsson Manufacturing Co., Ltd.

"*Proceedings* of the Physical Society of London." Vol. XXXII, Part 1. December 15th, 1919. London: Fleetway Press, Ltd. Price 4s. net.

"Post-Office Electrical Engineers' Journal." Vol. XII. Part 4. January, 1920. London: THE ELECTRICAL REVIEW, LTD. Price 2s. net.

"Diesel Engine Design." By H. F. D. Purday. Pp. xvi + 301; 271 figs. London: Constable & Co. Price 21s. net.

German Iron Industry.—An office is being set up in Berlin for the organisation of the entire German iron industry, including both import and export, under an Imperial Commissioner of the Ministry of Economy.—*The Times.*

The Housing Subsidy.—The Ministry of Health has issued regulations governing the payment of the new building subsidy. The object of the subsidy, on which the expenditure of £15,000,000 for the United Kingdom is authorised, is to secure the erection of 100,000 houses during the next 12 months. The regulations accordingly indicate that the subsidy is only to be earned by houses completed within 12 months of December 23rd, 1919 (the date on which the Act authorising it became law) or within such a further period, not exceeding four months in all, as the Minister may in a special case allow. In the case of houses completed within this longer period the Minister may, unless he is satisfied that the delay has been unavoidable, subject the grant to a reduction of one-twelfth for each month in which delay has occurred. The subsidy is to be £160, £140, or £130 per house, according to the number of rooms and the extent of floor area. In calling upon the Ministry of Health to pay the grant, the builder must have two certificates; one issued by the local authority authorising the houses to be constructed in accordance with plans previously submitted; the other by the local authority, declaring their completion in a proper manner. The builder will forward these certificates to the Ministry of Health, together with a written application for the money to which he claims to be entitled. The Ministry of Health, when satisfied as to the correctness of the claim, will pay the amount due. There are provisions for an appeal to the Ministry of Health in the event of either of these certificates being refused by the local authority. There is a schedule of regulations and a simplified specification based generally on the Ministry's specifications for houses built by local authorities under the main housing scheme of the Government.

Australia and Enemy Traders.—According to the Sydney correspondent of *The Times*, the Australian Federal Government has issued a special *Gazette* forbidding imports from, and exports to, Germany, Austria, Hungary, Turkey, and Bulgaria.

Trade with Russia.—It is announced that the Allies have decided to grant facilities to Russian co-operative organisations to import goods in exchange for certain commodities. It is also stated that the British Government has approved of a scheme for insuring British traders against any loss in re-opening trading relations. Agricultural machinery and machinery of all kinds is greatly needed. M. Litvinoff says that Russia has vast quantities of flax, hemp, hides, &c., waiting for export, also a large amount of platinum or platinum wares.

For Disposal.—*Surplus*, the official organ of the Surplus Government Property Disposal Board, seems to be bulkier than ever. No. 16, for January 15th (3d. net) contains a large section devoted to plant and machinery, while railway material, mechanical transport, office equipments, factory and miscellaneous stores, are in great variety.

Arc Welding.—THE ALLOY WELDING PROCESSES, LTD., inform us that "A.W.P." electrodes have been approved by Lloyd's Register of Shipping and by the British Corporation for the Survey and Registry of Shipping.

Electrical Business in South Africa. — The *South African Mining and Engineering Journal* (December 19th) stated that the Belgian Congo, the railway, and the municipalities were buying all electrical material very freely.

Calendars.—THE CITY ELECTRICAL CO., of 1, Emerald Street, London, W.C. 1, have sent us a wall calendar for 1920, with small monthly slips beneath a picture which sets you "Wondering." It is accompanied by an expression of good wishes and appreciations, and of gratitude to the trade Press for the invaluable assistance rendered by it to manufacturers during the difficult five years of war. Such messages soften the asperities of trade journalism in times when our production problems are as troublesome as ever.

THE NATIONAL X-RAY REFLECTOR CO., of Chicago, have issued a large wall calendar, with monthly date-sheets, each of which bears a large illustration showing some particular application of their reflectors.

MESSRS. JOHNSON & PHILLIPS, LTD., of Charlton, S.E., have again sent us one of their admirable blotting-pads, with interleaved diary, date indicator, and memoranda slips. Having used its predecessor for the whole of 1919, we know and appreciate its value and convenience.

MESSRS. ALFRED HERBERT, LTD., of Coventry, have circulated a finely executed calendar for 1920. The monthly sheets, which are perforated for tearing off, will probably be preserved for the excellent portraits that they give of kings, presidents, statesmen, and naval and military leaders who led the Allies to victory.

THE D.P. BATTERY CO., LTD., of Bakewell, Derbyshire, have not lost their appreciation of nature's scenery, which years ago stamped their calendars with a special character of their own. The one issued for 1920 has a charming coloured picture of sunshine and shadow, running water, and nature's freshest greenness, cool and restful on a summer's day, a glen in which to dream and to write poetry—not to be practical and write "Business Notices."

A desk calendar, with monthly cards, has been received from the BRITISH RAWHIDE BELTING CO., LTD., of Hythe Road, Willesden, N.W. 10.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C. 4, have issued a vest pocket calendar card for 1920. Electrical contractors can have quantities over-printed.

Catalogues and Lists. — CREDENDA CONDUITS CO., LTD., Chester Street, Aston, Birmingham. — Leaflet No. 103, dealing with "Creda" electric toasters, sterilisers, &c. Priced and illustrated. Illustrated and priced leaflet of the "Creda" pedestal fire.

THE LEA RECORDER CO., LTD., 28, Deansgate, Manchester.—Leaflet "T," users' comments on the "Lea" recorder, and Efficiency Diagram, M 3, showing the heat efficiency of a boiler when evaporation per lb. of coal is known.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—"Descriptive List No. 2,250 A," a 52-page catalogue of D.C. motors. Details of construction and capabilities are given very fully, and the list contains many illustrations.

CHARLES MAYFIELD, 19, All Saints' Road, Clifton, Bristol.—Leaflet relating to a business-control-chart system.

THE OVERSEAS ENGINEERING CO., LTD., 75, Curtain Road, E.C. 1.—Catalogue No. 125 (19 pp.), and Price Sheet No. 145, giving priced and illustrated information regarding small electric lighting outfits.

THE BRITISH RAWHIDE BELTING CO., LTD., Hythe Road, Willesden, N.W. 10.—Leaflet illustrating various rawhide manufactures, pinions, belting, mallets, &c., also a blotting card advertising these products.

Italian Electrical Companies.—The Società Italiana per Conduttori Elettrici Isolati, of Leghorn, has decided to increase its capital from 3,500,000 lire to 7,000,000 lire in order to be ready to take a large share in the supply of plant for the new inter-urban telephone extensions, and electric railway conversions, projected by this State.

There has been formed at Milan the Società Anonima A.B.G.D., with a capital of 1,000,000 lire, for the development of electro-mechanical patents and kindred apparatus.

The Società Ligure Pugliese Esercizio Imprese Elettriche has decided to write down its capital from 1,000,000 lire to 100,000 lire in consequence of the loss shown at the end of 1918, and to increase its capital by the issue of shares to 100,000 lire.

Safety First.—The British Industrial Safety First Association, 2 and 3, The Sanctuary, Westminster, S.W. 1, has recently published a poster setting forth the conditions under which the Gallant Conduct Award can be gained. This award is a silver medal designed and executed by the Goldsmiths and Silversmiths Co., Ltd., London.

New French Undertakings.—The Société d'Etudes des Forces Motrices du Haut-Daubs, with a capital of 300,000 frs., has been formed at Paris. It has for its object the development of the power of the Upper Daubs River.

At Grenoble, the Société Hydro-Electrique de Verdon-Moyen has been formed. The capital of this undertaking is 1,000,000 frs. The project is the derivation of power from the falls on the Verdon, near Castellane.

The Société d'Equipement des Voies Ferrées, recently floated in Paris, for the building and equipment of electric railways, has a capital of 1,300,000 frs.

For the manufacture and sale of "Idealith," "Meconite," and other insulating articles, there has been established, at Corbevoie, the Société pour la Fabrication des Isolants, with a capital of 300,000 frs.

New Swedish Cable Company.—A new company has recently been formed in Halsingborg, with the title of the Aktiebolag Halsingbergs Kabelfabrik, to manufacture electric and other cables.

Trade Representatives Overseas.—The following further appointments have been made by the Executive Committee of the Federation of British Industries :—

CUBA.—Mr. G. C. Musgrave has been appointed as a representative of the Federation in Cuba. He will be sailing at the end of this month.

MEXICO.—Mr. Antonio Gibbon, of 7A, Naranja 179 Mexico D.F., has been appointed as a Federation representative.

HOLLAND.—Arrangements for a permanent secretary are being made.

The Birmingham Fair.—It is expected that there will be heavy demands upon the accommodation that Birmingham is able to offer visitors during the run of the British Industries Fair, which opens on February 23rd. In order that the hotels may be as far as possible left free for buyers who are in attendance, it is suggested that exhibitors should avail themselves of apartments which the general manager will undertake to reserve for them and their assistants, if they will immediately intimate their requirements to him at the Chamber of Commerce, Birmingham.

Trade Announcements.—MR. ARTHUR IRELAND, for 20 years with the Electric Supply Corporation, has commenced business as a wiring and general electrical contractor at 12, Vicarage Road, Chelmsford.

MR. SIDNEY J. GOODSON, engineer and manufacturers' agent, has removed to 70, Wallingford Avenue, North Kensington, London, W., 10.

The Herne Bay Welding Co. (MESSRS. E. BROWN and D. T. FITZGERALD) have commenced business as electrical engineers, &c., at 8, High Street, Herne Bay.

The style of MESSRS. TURNERS & MANVILLE, LTD., has been changed to "Asbestos and Electrical Fittings Co., Ltd." There is no alteration in the constitution of the company or the conduct of the business.

MESSRS. PETO & RADFORD are removing their London headquarters from 12, Heddon Street, W., 1, to 50, Grosvenor Gardens, S.W., 1. New telephone number : "Victoria 3667"; telegraphic address : "Concentration, Sowest, London."

Bankruptcy Proceedings.—W. J. MCCOMBE, tramway manager, Kingston-upon-Hill.—Trustee (Mr. W. G. Hall), released December 30th, 1919.

W. MELLON (H. B. Wallis & Co.), electrical engineer, Chiswick.—First meeting, February 5th, at 14, Bedford Row, W.C.; public examination, February 24th, at Brentford.

Liquidations.—HERBERT FROOD & CO., LTD.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. J. Bell, 5, Clarence Street, Manchester, who is authorised to consent to the registration of a new company, Ferodo, Ltd., and to enter into an agreement with the new company. Meeting of creditors to-day at Manchester. Particulars of claims must be sent to the liquidator by March 25th.

ALEXANDER DUCKHAM & CO., LTD.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. L. A. Anderson, 2, Broad Street Place, E.C. Meeting of creditors, January 26th.

HOLME ELECTRIC CO., LTD.—Particulars of claims to be sent by February 10th to the liquidator, Mr. J. Alderson, Holme, near Holmfirth, Huddersfield.

ALFRED HERBERT (FRANCE), LTD.—Meeting of members called for February 20th, at The Butts, Coventry, to hear an account of the winding-up from the liquidator, Mr. D. M. Gimson.

A.E.G. ELECTRICAL CO. OF SOUTH AFRICA, LTD., 6, Old Jewry, E.C.—Last day for proofs for dividends to non-enemy creditors, February 2nd. Liquidator, Mr. H. de V. Brougham, Senior Official Receiver, Carey Street, W.C.

RADIUM, LTD.—Liquidator (Mr. H. de V. Brougham, Official Receiver) released January 5th.

BROLT, LTD. — Winding up voluntarily for reconstruction. Liquidator : Mr. E. Bosley, 120, Colmore Row, Birmingham. Particulars of claims to be sent to the liquidator by March 1st. Meeting of creditors, February 3rd.

NEW ST. HELENS AND DISTRICT TRAMWAYS CO., LTD.—Claims must be sent by February 28th to the liquidators, Messrs. H. P. Conibear and E. H. Edwardes, generating station, Howe Bridge, Atherton, Lancs.

CONNOLLY BROS., LTD.—Liquidator : Mr. J. McD. Henderson, 2, Moorgate Street Buildings, E.C.

LIGHTING AND POWER NOTES.

Aberdeen.—EXTENSIONS.—The electrical engineer recommends additions and extensions, costing £60,000, to meet increased demands. The proposals include the erection of two sub-stations and a considerable extension of distributing cables. During November last a total of 2,500,000 units was generated at the Dee Village Road station, an increase of 172,740 on the corresponding period of 1918.

Ammanford.—LIGHTING CHARGES.—The Council has been warned by Mr. Herbert, proprietor of the electric lighting undertaking of the town, that, unless it agrees to an increase of

50 per cent. in the charges, he will refuse to continue the supply. In the event of such an occurrence, the Council says it will apply for a Court injunction.

Arbroath.—STREET LIGHTING.—The Lighting Committee has agreed to accept the offer of the Arbroath Electric Light and Power Co. to re-install the public lighting system, at a cost of £6 10s. per lamp, for the period to Whit-Sunday this year. After this date the charge will be £16 per annum, subject to the taking over by the Town Council of the existing equipment at the price of £700.

Ayr.—INADEQUATE PLANT.—A Special Committee has been appointed to consider the electrical engineer's report that it is now impossible to supply further demands as the plant will not take a larger load. Demands have increased by 40 per cent. during the past year. The suggested scheme of extension and additions will cost £27,000. Among other things it is proposed to install new stoker gear and a rotary converter.

Barnet.—PROPOSED PRICE INCREASE.—The Town Council is opposing the application of the North Metropolitan Electric Lighting Co. for sanction to increase charges for electricity.

Barnsley.—EXTENSIONS.—The Town Council has approved a scheme of extensions and additions to the power undertaking, involving an expenditure of £40,000. One item is the erection of a sub-station at Town End, the cost of which will be about £1,200.

Blackburn.—EXTENSIONS.—The Town Council has received a number of applications from cotton-mill owners for a supply of power. This will involve the laying of new mains, as will also the projected wiring of the Blackburn Union Workhouse buildings.

Bradford.—EXTENSIONS.—The Electricity Committee has authorised extensions of mains in various parts of the city area, at a cost of £3,854

British Guiana.—HYDRO-ELECTRIC SCHEMES.—Not the least important of the schemes for the development of British Guiana is the utilisation of the waterfalls, with which the Hinterland abounds, for the purpose of hydro-electric energy. A preliminary survey of the Cuyuni, Essequebo, Demerara, and Potaro rivers has recently been made. The Conjoint Board of Scientific Societies, to which the report of the preliminary survey was referred by the Secretary of State for the Colonies, has recommended that automatic gauging stations should be erected on the rivers named, as well as the employment of an engineer, specially trained in hydro-electric work, to examine these localities in greater detail. Meanwhile, the preliminary report has been entrusted by the Committee to one of its members, who has had long experience of water power, with a view to getting further expert criticism. The Committee has also undertaken to co-operate with the Colonial Office in the selection, for the detailed examination, of an engineer whose reputation would be a guarantee of the value of his recommendations. The Combined Court has lost no time in authorising the expenditure to give effect to the recommendations of the Conjoint Board of Scientific Societies, and it will, therefore, be practicable for the Government to embark on the undertaking early in the coming year.—*Financier.*

Bromley.—SUPPLY FAILURE.—Due to a breakdown at the electricity works, Bromley, Chislehurst, and district were in darkness for several hours on Friday night, last week.

Canada.—RESTRICTIONS.—The excessive demands of power consumers have led to the imposition of severe restrictions by the Niagara Falls (Ontario) Commission. All signs and outside lights are forbidden, and power users are ordered to return to "daylight saving," starting earlier in the day and closing down at 4 p.m. Domestic supplies are also curtailed. These restrictions are calculated to reduce the load by 40 per cent.

Carlisle.—LOANS.—The Town Council has applied for loans of £5,000 for high-tension mains; £600 for services; £3,000 for transformers; and £1,500 for sub-stations.

Carmarthen.—PRICE INCREASE.—The Town Council has acceded to an application by the Electric Light Co. for leave to increase the charge for electric light for domestic purposes from 7d. to 9d. per unit, and for public lighting by 20 per cent.

Cheltenham.—LOAN.—As the existing plant has been found inadequate, the Town Council is to apply for sanction to borrow £29,000 for additions.

Clacton-on-Sea.—LOAN SANCTION.—Loans amounting to £5,500 have been sanctioned for the extension of mains, and for the conversion of the street lighting system from gas to electricity.

Continental.—HOLLAND.—The Low-Tension Network Installation and Working Co. (Mij tot Aanleg en Exploitatie van Laagspanning Netten), of Groningen, has just offered for subscription 6 per cent. bonds for 2,000,000 florins. The company was formed in 1915, the shareholders being the province of Groningen and the towns situated within the concession area of the provincial electricity works in Groningen and Drente.

AUSTRIA.—The coal shortage at Vienna is so critical, that in order to maintain even a scanty lighting in the streets and houses, from January 16th the electric tramway service in the city was to be completely suspended. Neither gas nor electricity may be used for industrial purposes, and shops, offices, and banks must not be lit after 3 p.m. All places of amusement must close, and the use of lifts is only permitted in hospitals.

Dartmoor.—HYDRO-ELECTRIC SCHEME.—The Dartmoor and District Hydro-electric Supply Co. has deposited its Bill for incorporation and powers to erect five stations on the banks of the Rivers North Teign, Lan, Tavy, Dart, and Erme.

Fife.—STREET LIGHTING.—The Kinghorn Town Council is considering a proposal to substitute electricity for the present system of gas lighting.

Eccles.—PROPOSED EXTENSIONS.—Although the charges for power and lighting have been advanced 75 per cent. above pre-war rates, applications from prospective consumers have so increased, that extensions are contemplated.

Hull.—REMOVAL OF RESTRICTIONS.—The restrictions placed upon the use of electricity for motive power have been withdrawn, but the ban on display lighting and the use of energy at kinema halls remains.

India.—WATER POWER.—A temporary Public Works Division has been constituted, with headquarters at Lahore, to be known as the Sutlej River Hydro-Electric Project Division, and Lieut.-Colonel B. C. Battye, D.S.O., R.E., has been posted to the charge of it.

Java.—HYDRO-ELECTRIC WORKS.—The Government of the Dutch East Indies is proceeding with a scheme for the erection of large hydro-electric works in West Java, to supply energy for the electrification of the railways and tramways, and for lighting and power purposes to municipalities. With a view to ensuring that the supply shall be afforded to the towns concerned at as low a charge as possible, the Government is endeavouring to bring together all the parties interested, including the Ned. Ind. Gas Co., of Batavia, which possesses the exclusive right to supply electricity in the town of Batavia until 1953. The Municipal Council of Batavia has, however, asked the Government to exclude the gas company from the proposed combination, the object apparently being to induce the Government to expropriate the company, which it can do in 1923 under the terms of the concession.

Knottingley.—The Board of Trade has revoked the 1914 Electric Lighting Order.

Loughborough.—EXTENSIONS.—Extensions providing an additional 6,000 KW. to the town's plant capacity, at an estimated cost of £150,000, are suggested. Mr. C. H. Wordingham, O.B.E., has been appointed consulting engineer for the scheme.

Lyme Regis.—INADEQUATE LIGHTING.—The Town Council has decided that it cannot pay the County of Dorset Electric Supply Co. in respect of street lighting for the quarter ended December 21st last. The reasons given for this are the ineffectiveness of the system, the length of time taken in repairing defects, and the inconvenience caused by roads still being up. The Council also states that, unless there is an immediate and substantial improvement, it will have to consider other means of lighting when the present agreement expires in May next.

Mexborough.—NEW STATION.—The erection of a 10,000-KW. generating station in the Adwick district at a cost of £500,000 is being contemplated. An arrangement between the Mexborough Council and the Yorkshire Electric Power Co. proposes to place the station under the control of a Joint Board.

Middlesbrough.—NEW STATION.—The Cleveland and Durham County Electric Supply Co., has expressed its regret at the Corporation's decision to augment the town plant in view of the negotiations proceedings between the two bodies for an additional supply of electricity to the town. The company asserts that, in conjunction with allied undertakings, it is erecting a power station at Haverton Hill, chiefly to meet the demands of Middlesbrough consumers. The station will have a capacity of 32,000 KW., and it will be necessary to lay a new high-tension network. The total cost, it is stated, will be considerably over £1,000,000.

The borough electrical engineer reported that the price quoted for a producer gas plant was very much in excess of his estimate and it has, therefore, been decided to continue taking a supply from the local gasworks for the present.

Monasterevan (Co. Kildare).—STORM DAMAGE.—During the recent storms the electricity company's pumping station was completely wrecked, and the majority of the power station plant put out of action, putting the town in darkness.

Monmouthshire.—FLOODED MINE.—Owing to the failure of the power supply and the consequent stoppage of the pumps, the Ellea Colliery, Pontnewyndet, was flooded, and work stopped for about three days.

Montrose.—PROPOSED PRICE INCREASE.—The Town Council is allowing the proposed increase of charges for electricity to 8d. per unit to stand over for a month, pending investigations into costs of production, &c.

Otley.—ELECTRIC SUPPLY.—The District Council is urging the Board of Trade to grant the necessary permission to the Yorkshire Electric Power Co. to install electricity in the town as soon as possible.

Stafford.—EXTENSIONS.—The Town Council is asking that the application for sanction to borrow £30,000 may be amended to provide for a sum of £65,000. It is proposed to install two 1,250-KW. sets, with accessories, one rotary converter, and transformers. New buildings will have to be erected.

South Shields.—YEAR'S WORKING.—The borough electrical engineer's report for the year ending March 31st, 1919, shows that the total income of the undertaking for this period was £42,169, and the expenditure £30,744, leaving a gross profit of £11,425. After the payment of loan interest, &c., however, the result was a deficit of £7,287. The total number of units generated was 5,766,398, and the maximum simultaneous load during the year was 2,709 KW.

Sunderland.—SUB-STATION.—The Electricity Committee has received permission from the Town Council to erect a transformer sub-station in St. Paul's Road. The total cost of the building, including equipment and site, is estimated at £3,325.

Tasmania.—HYDRO-ELECTRIC DEPARTMENT.—The fifth annual report (1918-19) of the Hydro-Electric Department shows that the revenue for the year amounted to £35,767, and the total working expenses to £25,087, leaving a gross profit of £10,680. The Department's total capital expenditure to June 30th, 1919, was £771,506. Extensive surveys have been made of the available water power, and a great deal of new construction is contemplated.

United States.—WATER-POWER BILL.—After a fight which has lasted for 10 years, the Senate has passed the Water-Power Bill, which provides for the creation of a commission for the licensing of water-power projects for a period of 50 years, at the expiration of which they will revert to the Government. They may, however, be re-licensed if it is deemed desirable. The Bill will now go before the House of Representatives.

TRAMWAY AND RAILWAY NOTES.

Bolton.—IMPROVEMENTS.—The Tramways Committee has recommended various improvements in the track, and also the acquisition of new cars.

Bradford.—CONTRACTORS' INCREASES.—Contractors for the supply of gear wheels for the Corporation tramways asked for a 20 per cent. increase on contract prices owing to the increased cost of production. The Committee has agreed to bear half of this extra cost.

Continental.—SWITZERLAND.—An avalanche fell near the Goppenstein-Loetschberg railway line late at night on January 11th, destroying the overhead electric railway equipment and interrupting traffic between Italy and Berne. Till the line was cleared, passengers were conveyed to Goppenstein by steam trains, but were obliged to make a detour on foot to join the electric railway further along the valley.

Leeds.—PARCEL SERVICE.—A net profit of £300 has been made during the past financial year on the parcel service of the tramways. Between April, 1918, when it was inaugurated, and September 30th last, the department dealt with 97,728 parcels, and of this total, 58,633 were carried during the six months ended September 30th. There is now a working arrangement for the carriage of parcels between the Leeds and Bradford tramways authorities, and between November, 1918, and September 30th, 1919, 23,000 parcels were carried between the two cities.

London.—ACCIDENTS.—A car on the District Underground Railway became derailed at Whitechapel about 10 a.m. on Monday, and both lines between Bow Road and Aldgate East were temporarily closed.

Due to an accident in the Chiswick High Road on Saturday morning last, the front of a L.U.T. tramcar was damaged, and a P.O. letter-box was knocked down.

A stoppage of 40 minutes was caused on the Bakerloo tube by a defective shoe on Monday.

Newcastle.—YEAR'S WORKING.—The report of the engineer and general manager of the Corporation tramways for the last financial period showed a total revenue of £472,094, or 18·94d. per car-mile, as compared with 16·82d. for the previous year. Working expenses increased by £58,096 to £306,490. Rates and taxes amounted to £34,427. During 1918-19 the number of passengers increased to 101,631,660 from the previous year's figure of 91,648,545.

Plymouth.—EXTENSIONS.—To enable the Corporation Tramways Department to deal with the requirements of the travelling public, it is proposed to double the power supply. Twenty additional cars are to be put on, the tramways are to be extended on seven different routes, 30 omnibuses are to be provided, and a parcel-carrying system is to be established.

Salford.—EXTENSIONS.—The Tramways Committee has again been requested to extend its lines to Irlam, about four miles away, to serve the population of this growing industrial locality.

Swansea.—TRANSPORT.—Strong opposition was offered at a ratepayers' meeting to clauses in the Corporation Bill providing for the establishment of motor-'bus services in lieu of tramway extensions. It was pointed out that the cost of the latter was now "prohibitive," the estimate being £30,000 per mile, and that if the deletion of the clause referred to was insisted on, it would deprive important areas of transport facilities. Alderman T. J. Richards said the interests of 150,000 people in the outside areas had to be considered. The proposal to delete the clause was defeated, but a second amendment, deleting clauses relating to the provision of transport facilities for any district outside the borough, was carried.

Tyneside.—TRAMWAY PURCHASE.—The proposal of the Newcastle Corporation to purchase the Tyneside tramway undertaking is being opposed by Wallsend and Tynemouth.

Wolverhampton.—FARES.—The Tramways Committee is strongly opposed to the reinstatement of penny fares. The manager states that, although operating costs had increased from 6·551d. per car-mile in 1913-14 to 12·356d. in 1918-19, only a halfpenny had been added to the original penny fares. The Committee has, however, decided to reduce the price of workmen's tickets.

TELEGRAPH AND TELEPHONE NOTES.

A New Wireless "Calling-Up" Device.—A new wireless "calling-up" system intended mainly for saving life at sea, has been devised by the Marconi Co., and was recently demonstrated at Chelmsford. The device will enable a ship in distress to automatically ring alarm bells on board any vessels within range, and will do away with the necessity for an operator to be always on duty. The apparatus consists of an automatic transmitter, which will send out a special signal with accuracy, and a reliable receiver which will respond to this signal, and this signal only. It will ensure general and immediate attention being given to emergency calls, such as "S.O.S." and "T.T.T.," the ice warning. The device was used, it is stated, during the war for exploding mines, and its action was illustrated at the Marconi Works on January 15th, gunpowder being fired by wireless from a station 30 miles away.

Federated Malay States.—The *Times Trade Supplement* announces that large sums are being expended to improve the telephone and telegraph systems of the Federated Malay States. A trunk telephone line between Perak and Selangor is to be laid. Much material is required in connection with these developments.

India.—The telephone trunk connection between Lucknow and Allahabad was established on December 8th. It is hoped to have automatic telephone exchanges established in Lucknow and Cawnpore by the end of the cold weather, and a central battery system installed in Allahabad.

Strikes.—At midnight, on January 13th, a general strike of postal, telegraph, and telephone employés was put into execution throughout Italy, and all these services were suspended. The telegraph offices were guarded by troops. The men asked for increased wages, higher bonuses, and higher overtime pay; the Government seemed disposed to meet the demands, but the men struck suddenly against the advice of their leaders. A few men remained at their posts in Rome, and a few urgent telegrams and Press messages were dealt with; the telephone service was maintained for newspapers within an immediate radius of Rome, and a similarly reduced service was maintained in other large towns. The naval wireless stations have been placed at the disposal of the public whenever possible. The strike is complete in Northern Italy, less so in Central Italy, and only very limited in Southern Italy, Naples, Sicily, and Sardinia. At Palermo, Catania, and nearly all Sicily, in the Abruzzi, at Molise, Foggia, and other places, the employés refused to obey the order to strike, and the public services continue. In Rome 30 per cent. obeyed. During the night telegraphic and telephonic communication was re-established for Government and Ministerial purposes, with many centres in Northern Italy. The foreign telegraph service was, however, completely suspended.

It is reported that numerous telegraph lines in the West of Germany were wrecked by the workers during the recent strike and other riots. Telegrams from Berlin to England, France, and elsewhere are subject to several days' delay owing to the damage done to the wires in the west and south-west by the recent storms.

In Belgium the postmen's strike tends to increase, and has extended from Brussels to Antwerp, Mons, Charleroi, and other places. The strike coincided with the gales, which suspended telegraphic and telephonic communication in many directions.

A strike has been declared by the telephone operators at Oporto, who belong to the same Union as the telephone operators who are on strike in Lisbon.

Masked and armed persons entered the central telephone exchange at Lisbon at night, and removed a number of indispensable instruments. The telephone service had for a time to be suspended.

United States.—After exhaustive investigations and long experiment, the New York Telephone Co., has developed a machine-switching central-office system of automatic telephones that has proved so satisfactory in a number of practical trials as to warrant its use in several places, says the *Electrical World*. Installations at Dunkirk, Ithaca and Geneva were expected to be completed early this year. In New York City it is proposed to place this apparatus in three new central offices, but none of these installa-

tions can be completed before the end of this year. The Telephone Co. is carrying out a reconstruction and expansion programme to meet the heavy demand for service that continued throughout 1918, and to regain the ground lost during 1917 and 1918, when no telephone work other than that needed for Government purposes was permitted. In 1918, in addition to the large increase in the volume of traffic from existing stations, there was a net gain in new stations installed since January 1st, 1918, of 100,000 in New York City and its immediate vicinity. The new system will not do away with the need for operators; in New York City the operating force was increased by 2,000 new workers in the last nine months of 1918, and 1,000 more are expected to be engaged in the first few months of this year. There will be no curtailment of this force, which soon will number 12,000. Experience has shown that the best method of changing from one type of apparatus to another is to use the new type on all larger replacements and for taking care of growth so that the most modern types of equipment can be gradually brought into use with the least amount of disturbance to the service and loss of time, and without any radical effect upon employés or upon the financial situation. The different types of equipment will interconnect without difficulty. The system is extremely simple to operate. Instead of telling the desired number to an operator, the subscriber indicates it himself by manipulating a dial attached to the regular telephone instrument. This dial is equipped with 10 finger holes, each carrying one of the 10 numerals. In some cases the dial will be marked with certain letters of the alphabet. In addition to the development in New York, installations of the new system are understood to have been made also in several cities in the territory of other Bell companies.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen.—January 31st. Electricity Committee. Two water-tube boilers, with superheaters, economisers, steel chimney and accessories. (January 9th.)

Aldershot.—February 17th. Urban District Council. Electricity Department. Geared turbine and generator, condensing plant, pumps, water-tube boiler and superheater, cables, &c. (See this issue.)

Australia.—SYDNEY.—March 1st. Municipal Council. Supply of 2,000-K.V.A., 5,000 to 10,000-V. transformers. Electric Lighting Department, Town Hall.

March 10th. City Council. Supply of 6,600-V. switchgear for sub-station switch houses, &c., and of six 250-K.V.A., three-phase transformers. Specifications from City Electrical Engineers' Office, Melbourne.—*Industrial Australian and Mining Standard.*

Belfast.—February 14th. Tramways Committee. Tramway stores, including electrical accessories, cable, lamps, carbon brushes, trolley wire, &c. (See this issue.)

Bray.—January 30th. Urban District Council. Electricity Works. One 200-B.H.P. Diesel engine, direct coupled to a 135-K.V.A. single-phase alternator and exciter. (January 9th.)

Bradford.—January 28th. Corporation. Two electric battery locomotives. (December 26th.)

Colne.—Electricity Department. New or second-hand 1,250-KW. to 2,000-KW., 6,600-V. turbo-alternator, with condensing plant. (January 16th.)

Edinburgh.—February 9th. Electricity Supply Department. One overhead travelling crane. (January 16th.)

Greenock.—February 3rd. Corporation. Electrical installation work at 114 houses. Particulars from Mr. A. Nimmo, Town Clerk.

Ilford.—January 27th. Urban District Council. Electricity Department. One 1,000-KW. converting plant, cooling tower, motor-driven air compressor, L.T. cables. (January 9th.)

London.—ISLINGTON.—January 28th. Electricity Committee. Stores, including cables, meters, electric lamps, &c., for 12 months. (December 19th.)

New Zealand.—AUCKLAND.—September 1st. Harbour Board. 12 5-ton (and alternatively 12 3-ton) semi-portable balanced jib level Luffing electric cranes. Specifications from the Agents of the Board, Messrs. W. & A. McArthur, Ltd., 18/19, Silk Street, Cripplegate, E.C.

Pontypridd.—January 30th. Urban District Council. Electricity Department. Rotary converter, transformer and switchgear. (January 9th.)

Stockton-on-Tees.—February 5th. District Fund, Gas and Electricity Committees. Articles and stores for six months. (See this issue.)

Warrington.—February 10th. Electricity and Tramways Committee. Two water-tube boilers; two mechanical stokers (underfeed type); water softener. (See this issue.)

Whitby.—January 30th. Urban District Council. Turbo-alternator, condenser, air and circulating pumps, water-tube boiler, rotary converter, transformer, A.C. switchboard, E.H.T. cables. (See this issue.)

CLOSED.

Barnsley.—Electricity Committee :—

H.T. switchgear.—Ferguson, Pailin, Ltd., £292.
L.T. cable.—B. I. & Helsby Cables, Ltd., £595.
1,500-KW. turbo-alternator, complete with condensing plant, air filter and recording apparatus.—English Electric Co., £23,879.
Water-tube boiler, stoker, economiser and induced-draught fan.—Babcock and Wilcox, Ltd., £8,545.
One turbine boiler feed pump.—Mather & Platt, £446.

Bradford.—Tramways Committee :—

87 standard-type car trucks, £19,140; 124 electrical tramcar equipments, £48,059.—English Electric Co., Ltd.
20 tramcar bodies, £29,900.—English Electric Co., Ltd.

Electricity Committee :—

Three 150-K.V.A. and two 60?-K.V.A. transformers.—Ferranti, Ltd.
Three 250-K.V.A. tranformers.—Brush Electrical Engineering Co., Ltd.
Two 400-K.V.A. transformers.—British Electrical Transformer Co., Ltd.
A.C. "B1" switchgear, Bolton Road sub-station (including gear for two additional rotaries and Merz-Price protective gear).—A. Reyrolle & Co., Ltd.

Belgium.—The Belgian State Railway Authorities in Brussels recently invited tenders for the supply of a large quantity of electric cables. There was keen international competition for the orders; among the British firms tendering being the Enfield Cable Works, Ltd.; Henley's Telegraph Works, Ltd.; the Metropolitan-Vickers Electrical Co., Ltd.; and the B. I. & Helsby Cables, Ltd. The last-named concern submitted the lowest tenders for several of the lots, totalling 168,000 metres of cables of different kinds.

Dublin.—The Port and Docks Board is purchasing from the Dublin Dockyard Co. three electrically-driven winches for £550.

Epsom.—Urban District Council :—

Repairs to Diesel engine at the electricity works.—Banks, Warner & Co., £918.

Sheffield.—The Birmingham *Post* says that Labour representatives have raised strong objection in the Sheffield Corporation to the practice of that body in placing large contracts for engineering material without disclosing details of prices. The recommendations of the Electricity Committee, relating to certain contracts for machinery and material, were, in consequence, sent back for fuller information. It was stated that in one case the amount involved was over £60,000, but that fact was not disclosed in the minutes.

Sunderland.—Electricity Department :—

Metering gear.—General Electric Co., Ltd.
Service cable.—Pirelli-General Cable Works, Ltd.

FORTHCOMING EVENTS.

Electrical Power Engineers' Association (West Yorks. Section).—Saturday, January 24th. At the Y.M.C.A., Albion Place, Leeds. At 6.45 p.m. Lecture on "The Legitimate Sphere of Trade Unionism," by Mr. F. Kirkley.

(Derby and District Section).—Saturday, January 31st. At the Albert Hotel, Nottingham. At 7 p.m. Address by the President.

Institution of Civil Engineers.—Tuesday, January 27th. At Gt. George Street, S.W. At 5.30 p.m. Further discussion on papers on "Whitby, Blyth and Sunderland Harbours."

Illuminating Engineering Society.—Tuesday, January 27th. At the Royal Society of Arts, John Street, Adelphi. At 8 p.m. Discussion on "Colour Matching by Natural and Artificial Light," to be opened by Mr. L. C. Martin.

Institution of Electrical Engineers (South-Midland Centre).—Wednesday, January 28th. At the University, Birmingham. At 7 p.m. Paper on "Failures of Turbo-generators and Suggestions for Improvements," by Mr. J. Shepherd.

(North-Eastern Centre).—Monday, January 26th. At the Armstrong College, Newcastle. At 7.15 p.m. Paper on "Failures of Turbo-generators, and Suggestions for Improvements," by Mr. J. Shepherd. Friday, January 30th. Annual dinner.

(North-Western Centre).—Tuesday, January 27th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Transformers for Electric Furnaces," by Mr. J. L. Thompson.

(Students' Section).—Friday, January 30th. At the City and Guilds Engineering College, Leonard Street, Finsbury, E.C. At 7 p.m. Discussion on "Quantity Production as a Panacea," to be opened by Major K. Edgcumbe, R.E. (T.)

Edinburgh Electrical Society.—Wednesday, January 28th. At 8 p.m. At the Philosophical Institution. Discussion on the I.E.E. "Regulations for the Electrical Equipment of Ships," introduced by Mr. D. S. Munro.

Wireless Society of London.—Thursday, January 29th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Illustrated lecture on "A Portable Valve Set and some Properties of C.W. Circuits," by Mr. R. C. Clinker.

Royal Institution of Great Britain.—Friday, January 30th. At Albemarle Street, W. At 9 p.m. Lecture on "The Gyrostatic Compass," by Mr. S. G. Brown, F.R.S.

Saturday, January 31st. At 3 p.m. Lecture on "The Astronomical Evidence Bearing on Einstein's Theory of Gravitation," by Sir F. W. Dyson F.R.S.

Junior Institution of Engineers.—Friday, January 30th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "The Manufacture of Hydrogen Gas by the Silicol Process, for Airships and Commercial Purposes," by Mr. G. E. Lygo.

Royal Photographic Society, Russell Square, W.—Exhibition of prints lent by the Röntgen Society. Open till February 7th.

NOTES.

Concert.—The Sheffield Electrical Social Union held a grand Bohemian concert at the Royal Victoria Hotel, Sheffield, on the 15th inst. The proceedings, which were very successful, lasted from 7 to 11 p.m. Messrs. F. H. V. Hooper and F. Leng acted as musical directors. Mr. A. Lucas is president of the Union, and Mr. A. Walker, of 15, Cleveland Street, Sheffield, fills the office of secretary.

Ramsay Memorial Fund.—The Sloan Electrical Co., Ltd., acting upon instructions received from Messrs. Philips' Glowlampworks, Ltd., Eindhoven, Holland, has forwarded a donation of £500 to the Organising Secretary of the Ramsay Memorial Fund.

Accident.—While Edward Owens, an operator at the Larbert (Stirlingshire) Picture Palace, was doing some repairs to the electrical connections which control the action of the kinema machine, his pliers came in contact with a live piece of steel, with the result that he sustained a 400-volt shock, causing severe burns to both hands. At last news he was in a serious condition.

Wireless Telephones for the Yukon.—Recent gold discoveries in British Columbia have resulted in a call for telephonic communication over snow-bound land, where no roads have yet been cut. A Yukon member of the Overseas Club has written to the Overseas Trade Bureau, asking to be put in touch with a firm which can supply wireless telephone outfits to connect Dawson and a camp 200 miles distant.—*Daily Chronicle.*

Electric Refrigerators.—In order to determine accurately the best type of machinery to install in a new refrigerating plant, a firm of consulting engineers of New York made a detailed analysis of the initial and operating costs. This plant was to have a total capacity of 600 tons based on a brine temperature of − 15° F. (− 26° C.) with a suction pressure of 3 lb. (0·2 kg.) gauge and a condenser pressure of 155 lb. (11 kg.). Consideration was given to the following types of installation:—(1) Absorption machines; (2) Steam-driven compressors with Corliss engines; (3) Steam-driven compound compressors; (4) High-speed simple compressors driven by synchronous motors; and (5) High-speed compound compressors driven by synchronous motors. The cost of equipment for these various methods of operation was found to be $277,113, $238,728, $237,728, $158,165, and $157,165 respectively, making the motor-driven high-speed compound compressor installation cheapest. The operating expenses under the five methods of operation considered are about as shown in the

OPERATING EXPENSES.

Type of plant.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Cost of plant	$280,000	$240,000	$240,000	$160,000	$160,000
Power or fuel per year (tons and kw.)	8,730	5,075	4,475	5,758,700	5,026,700
Cost power or fuel per year	*$27,500	$15,986	$14,100	$45,000	$41,250
Staff	13,475	13,475	13,475	10,505	10,505
Maintenance	8,750	6,800	6,800	4,000	4,000
Oil, waste, ammonia, water, &c.	10,000	7,530	7,350	4,000	4,000
Total operating expense	59,725	43,791	41,725	63,505	59,755
Interest, 6 per cent.	16,800	14,400	14,400	9,600	9,600
Depreciation, 3½ per cent.	9,330	8,020	8,0.0	5,330	5,330
Insurance	280	240	240	160	160
Total plant expense	$86,135	$66,431	$64,365	$78,595	$74,845
Deduct rental for space released by use of electrically-driven plant	—	—	—	14,000	14,000
Total net plant expense	$86,135	$66,431	$64,365	$64,595	$60,845

*Coal at $3·15 per long ton and energy at 0·00825 per kilowatt-hour.

accompanying table. Again the cost is less for motor-driven compound compressors. As a result of these estimates four refrigerating machines were installed, each to be driven by a synchronous motor. The other electrical equipment consists of six 500-KW. transformers which convert energy from 7,830-volt, three-phase, 61½-cycle to 1,950-volt, two-phase energy.—*Electrical World.*

"Eda" becomes "Beda."—On January 17th there was egistered at Somerset House the British Electrical Development Association, a company limited by guarantee, to promote and protect electrical industry and enterprise in the British Empire, and to develop the demand and uses of electricity.

Tube Improvements.—A correspondent of the *Daily Telegraph* suggests a scheme for the relief of the present congestion on the London underground railways. This is the provision of a central platform for in-going passengers only—the existing side platforms being used for unloading passengers. Trains would thus have a platform on either side. The cost is not likely to recommend the scheme to the serious attention of the railway companies, although no doubt the result would justify the expenditure from the travellers' point of view.

Fuel Research.—The Lord President of the Council has approved the appointment of Colonel Sir Frederic Nathan, K.B.E., late R.A., to be Power Alcohol Investigation Officer under the Fuel Research Board of the Department of Scientific and Industrial Research. Prof. Pierce Purcell, who was secretary of the Irish Peat Inquiry Committee, has also been appointed to act as Peat Investigation Officer under the Fuel Research Board. The duties of the Peat Investigation Officer will be to keep the Board informed of all progress in connection with research into the utilisation of peat, to continue and extend experiments on the mechanical cutting and winning of peat, and to make arrangemen : fo ca·eful tests of the use of peat as a fuel under boilers.

Water-Hammer in Pipe Lines.—In *Le Génie Civil* of January 3rd, there appears an article by M. A. Causse on the phenomenon of water-hammer in the pressure conduits of hydraulic power installations. The author points out that with a view to economy of capital in modern practice, the speed of the water has been raised from 2 or 3 metres per second to 5 or 6 metres, with the result that water-hammer has greatly increased in importance. The phenomenon is exceedingly complex. The author deals with the problem analytically and shows that the shocks due to water-hammer can be predetermined, the calculated values agreeing well with experimental results.

Scientific Management.—With a view to educating the public, particularly those people engaged in commercial activity, in this subject, the Industrial League and Council has organised a series of lectures to be given in the Conference Hall of the Central Hall, Westminster. Among the speakers, together with their subjects, who are due to give lectures, are:—Mr. J. F. Butterworth, "Modern Methods in Industry"; Major E. A. Pells, "Conditions the Workers May Control"; Mr. W. J. Grosart, "Evolution of Modern Methods in Industry"; Mr. H. Atkinson, "Economical Production and Prevention of Waste"; Mr. F. C. Laurence, "The Effect of Modern Industrial Methods on Employment and Wages"; and Mr. J. F. Butterworth, "Results Achieved in Industry by Modern Methods." Anyone desirous of attending the conferences can obtain full particulars from the Secretary to the Industrial League and Council, at 66, Victoria Street, S.W. 1.

Electricity Supply Act.—The *London Gazette* for January 20th, publishes the following notice issued by the Ministry of Transport:—"That it is proposed to issue an order in council, under the title of 'The Ministry of Transport (Electricity Supply) Order, 1920,' whereby the 23rd of January, 1920, will be fixed as the date from which the duties of the Board of Trade in relation to the matters specified in the Act will be transferred to the Minister of Transport."

Inquiries.—Makers of "Limpet" plugs are asked for.

Educational.—UNIVERSITY COLLEGE, UNIVERSITY OF LONDON.—An appeal has been issued for £100,000 for the purpose of erecting new engineering laboratories for the College. The School of Engineering was established as long ago as 1828, and has to its credit the names of many distinguished engineers; the present buildings were opened in 1893, and are totally inadequate for the accommodation of the students already in attendance, to say nothing of those who seek admission. One important feature of the new scheme is an hydraulic laboratory, to be called after the late Mr. Charles Hawksley. Lord Cowdray has given £10,000 to the fund, with a conditional promise of another £10,000. Donations may be sent to Prince Arthur of Connaught, 42, Upper Grosvenor Street, W. 1, or to Sir Ernest Moir, at the College. We commend the scheme to our readers, especially those who are old students of University College.

Fatalities.—An inquiry was held on January 8th by the Manchester City Coroner (Mr. C. W. W. Surridge) into the circumstances attending the death of a seven-year-old child named Florence Pearson, who was knocked down by a tramcar when crossing the street and died a few minutes later. The driver of the car said he sounded his gong and applied the brakes, but could not bring the car to a standstill in time. The safety device in front of the car could not pick her up owing to the peculiar manner in which she fell. If she had been a bigger person she would have been automatically placed on the safety frame, but as she was very small, the body was dragged under the lifting portion. A verdict of "Accidental Death" was returned, the Coroner stating that no blame was attached to the driver.

Found lying in an outhouse with her hair caught in the engine of a plant for lighting the house by electricity—which her brother, aged 20, had fitted up, and taught her to control—Doris Little, 15, of Tottenham, died in hospital from scalp wounds. At the inquest, on January 14th, it was stated that she was very proud of being able to start the engine. She had told her mother that she was turning off the switch so as to save current.—Verdict, "Accidental Death."

The Hvid Engine.—A recent issue of *Power* describes, in detail, a little-known internal-combustion engine for which it is claimed that it possesses all the advantages and none of the disadvantages of the Diesel type. The Hvid engine is designed to run on paraffin, and is of the four-cycle type. Its chief features are the elimination of ignition devices and the use of compressed air, as both principles are embodied in the operation of the engine itself. Briefly its action is as follows:—On the first (suction) stroke a charge of air is admitted to the cylinder, and at the same time a fuel valve opens and fills a small cup. On the compression stroke, the air is subjected to a pressure sufficient to raise it to a temperature high enough to ignite the more volatile elements of the oil in the cup. This causes a small explosion which forces the rest of the oil into the compression chamber. The heated air in this chamber causes rapid combustion to take place, and the piston is forced back. The exhaust stroke then drives out the products of combustion. In addition to the advantages previously mentioned, the fuel consumption is small, and the engine will operate on any oil that flows. It has been produced in sizes as low as 1½ H.P. The article contains curves showing the relative fuel consumption of the Hvid engine and other types. At 8 B.H.P. the consumption of the Hvid is given as ·44 lb. per B.H.P.-hour, as compared with ·61 for a paraffin-driven engine with throttling governor, and ·74 for a petrol engine with a "hit and miss" governor.

Prize Awards.—The French Academy of Sciences has awarded part of the Plumey prize (1,500 fr.) to M. Maurice Poincet, for his researches on the blades of steam turbines; the Kastner-Boursault prize to M. Maurius Latour, for researches on electric motors; the Gaston Planté prize to M. E. Brylinski, for work in applied electricity; the Hébert prize to M. Raymond Jounaust, for work on magnetism, electrical standards, photometry, and wireless telegraphy; the Hughes prize to M. Henri Chaumat, for work on ozone, indigo and other dyes, and electrotechnics; the Pierson-Perrin prize to M. Georges Sagnac, for work on secondary X-rays; and the Clément Félix foundation to M. Charles Féry, to enable him to continue experiments on the production of a small dry accumulator.

Appointments Vacant.—Assistant sub-station attendant (77s. 1d.), plumber-jointer (98s. 3d.), jointer's mate (78s. 2d.) for the Stoke Newington Borough Council electricity department; junior mains assistant and draughtsman (£4) for the Cheltenham Corporation electricity department; meter repairer (mechanician) (39s. + 33s. 6d. + 12½ per cent.) for the Lancaster Corporation electricity works; overhead linesman (79s.) for the Burnley Borough electricity department; cable jointer for the Bacup Corporation electricity department; E.H.T. plumber-jointer (94s.) for the Swansea Corporation electricity department. See our advertisement pages to-day.

Naval Telegraphist Ratings.—It is officially announced that in future all telegraphist ratings who have passed as telegraphists, and are otherwise qualified for entry, may be enrolled in the Royal Fleet Reserve.

Radiographic Exhibition.—An interesting exhibition of X-ray photograms is being held by the Röntgen Society, at the Russell Square Rooms of the Royal Photographic Society. The progress achieved in this art is evidenced by a comparison between the first radiogram from a human hand made in London 24 years ago, with 20 minutes' exposure, and one taken last month with an exposure of $\frac{1}{100}$ second.

Liverpool Electricians' Lock-Out.—On Monday a lock-out was declared by a number of Liverpool employers in the electrical contracting industry, the National Federated Electrical Association having adopted the following resolution:—"In consequence of the action taken by the Electrical Trades Union in withdrawing their members from certain firms in the National Federated Electrical Association, owing to the non-ratification of the new rules by the National Joint Industrial Council, this Association declares a lock-out of all Electrical Trades Union men employed in the Building Section (other than staff hands), as and from 5.30 p.m., January 19th, 1920." It is stated locally that the new working rules had been agreed by the District Joint Industrial Council, but had not been ratified by the National Joint Industrial Council, which put forward a number of amendments. The Union, however, admits the National Council's right to veto, but as it had not done so, claims that the rules should be in operation. A number of men ceased work last week-end to enforce recognition of the new rules, and the employers responded by the declaration of a lock-out. It is understood that some 400 men have ceased work in Liverpool and district.

The "Electrical World" of New York.—We congratulate our contemporary upon having emerged from the difficulties occasioned by the strike in the printing trades in New York. The issue of December 27th, just to hand, states that the paper was then returning from its temporary home at Buffalo, where nine issues had been published, to its home quarters in New York.

Appointments in India.—In its issue of November last, *Indian Industries and Power* refers to the growing demand for engineers in India, and for skilled men in most industries, and quotes with approval the letter of Mr. W. T. I. Turner, which appeared in our issue of September 26th. Our contemporary says:—"There is a great deal in these warnings. Although the rupee has risen over 2s., there has been a corresponding rise in the cost of living, and in Bombay a single man will have much trouble in getting accommodation at Rs. 150 a month. The average in the hotels would be Rs. 300 per month, and there is difficulty in getting a room even at that price. In private boarding houses the charges have risen with the great demand. With the Japanese elbowing the European out of the residential districts and the dearth of hotels and boarding houses in Bombay and Calcutta, we may say that the position has grown worse. Firms bringing out new men must find accommodation for them, and to do this they had better devote their early and prompt attention to the suburbs, and purchase what bungalows are available, or arrange to build. Further, it would be advisable to give the new-comers a full and frank statement of the conditions and the cost of living. We would like to see every firm handle this subject in a similar manner to that employed by the Tata Co. Their booklet on the living conditions at Jamsedpur is one of the fairest and most explicit we have seen. It might be improved by a few illustrations, but that is a detail. It prevents a man from feeling that he has been brought out here under false pretences, and tends to make him have confidence in his firm and his prospects. Employers of European labour in India do not give sufficient attention to these matters, and very often find their staffs discontented and unhappy in their surroundings. The European engaged for work in India is entitled to careful consideration, and if he is a married man, his case has a special claim, for the outlook for a married man with a small family is distinctly gloomy."

The Accident to Submarine "K.13."—One of the most thrilling and absorbing war stories that we have seen was contained in an address by Mr. Percy A. Hillhouse, B.Sc., to the Greenock Association of Engineers and Shipbuilders, which was reproduced in *The Channel* for November, 1919.

It will be remembered that "K 13" was one of two submarines ordered from the Fairfield Co. late in 1915; she was no less than 330 ft. long, displaced 2,600 tons, and was fitted with water-tube boilers and turbines for surface propulsion; for under-water work she had the usual battery and motor equipment. Her normal crew numbered 52. After preliminary trials, including successful submergences, on January 29th, 1917, she dived in the Gareloch to 83 ft. for two hours, and was accepted as satisfactory. A second short dive was undertaken, with 80 persons on board, including representatives of the Admiralty, the builders, and various contractors; amongst these were Messrs. D. Renfrew and S. R. Black (Kelvin, Bottomley & Baird), W. V. Hancock (Admiralty electrical overseer), E. J. Skinner, manager, and his assistant, F. Neate (electrical department, Fairfield Shipyard), and the author (naval architect, Fairfield Shipyard). The dive commenced, but almost immediately it became evident that something was wrong, and the ship sank rapidly; water was found to be pouring into the boiler room, and the watertight doors were closed. A jet of water through a voice pipe caused short-circuiting on the switchboard, blowing fuses and setting the cables on fire; attempts to smother the flames with wet sacks resulted in shocks, until means were devised to avoid that trouble, and the pungent smoke was highly irritating. Every effort was made to rise by blowing out water and letting go the drop keels, without effect. Fortunately the batteries were fully charged, and energy was available for lighting, pumping, and compressing air. The situation appeared desperate, and all felt that there was no hope of escape. The unusual appearance of the dive had attracted attention on the surface, and the work of rescue was immediately put in hand. On the ship, 48 persons were gathered in the forward portion, including all those named above except Mr. Neate, in a space of about 12,000 cu. ft., and it appeared that the supply of oxygen would last for about six hours; actually the prisoners were entombed for 42 hours, in an atmosphere in which a match would not inflame. The compressed air store was drawn upon gradually, but breathing became painful and difficult. All the while, the danger that the salt water would reach the batteries and generate chlorine gas was present. How the two commanders, Herbert and Goodhart, took the desperate chance of leaving the vessel to inform the rescuers as to the conditions, we have not space to tell; the former perished, but Commander Goodhart, who had not intended to make the attempt, was blown out by a fortunate chance and rendered invaluable assistance at the surface. Eventually the bow of the vessel was raised by blowing in compressed air from above; but the danger of chlorine gas was increased by this, as the water could not be pumped out. At intervals throughout the ordeal, fuses blew on the switchboard and the corresponding lights were extinguished. In altering connections to an air compressor a short circuit was made which blew the main fuse, and put the whole ship in darkness for the last six hours. After 55 hours' durance of the vilest, all were released, but next day the ship again sank to the bottom. It was found that the four air inlets to the boiler room had been left open when submerging; the man who forgot them paid for his error with his life. Mr. Skinner was one of those to whom the Admiralty awarded special commendation for their services. The story, which is highly detailed, is of surpassing interest.

Water Power in the U.S.A.—The Secretary of the Department of the Interior in his last annual report, emphasises the necessity for further hydro-electrical developments. The Geological Survey has estimated the total available water power in the States as 54,000,000 H.P. The last official census, taken in 1912, showed that the developed power from this source was only 4,870,000 H.P., about 9 per cent. of the total resources.

Fixation of Nitrogen.—The U.S. Government has introduced a Bill into the Senate and House of Representatives providing for the formation of a Fixed Nitrogen Corporation. The corporation stock will be owned exclusively by the Government. The functions of this body will be the manufacture, production, and development of atmospheric nitrogen, chiefly for military and agricultural purposes. The Bill empowers the Corporation to purchase existing plant, and to take over the hydro-electric undertaking at Muscle Shoals when completed.

Australian Postal Finance.—The Postmaster-General of Australia reports a surplus of approximately £556,804 for the year 1918-19. The total earnings of the postal system were £6,158,029, while the working expenses, including interest, amounted to £5,601,225. The last year's profit was £387,382. Every branch increased its business, and the following advances on last year's earnings were given:—Telephones, £161,314; telegraphs, £81,677; and postal, £140,884. The Postmaster-General states that the year's profit is equivalent to the interest on a £20,000,000 war loan.

An American Electric Car.—The *Light Car* announces that an American concern is contemplating the production of an electrically-driven light car weighing less than 10 cwt. It will carry its own "charging plant" in the form of a small air-cooled engine.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Arrangements for the second part of the session, 1919-20, are as follows :—

ORDINARY MEETINGS.

February 12th.—Major K. Edgcumbe, R.E. (T.), "The Protection of Alternating-Current Distribution Systems without the use of Special Conductors."

February 26th.—Reginald Morton, M.D., "On the Efficiency of High-Tension Transformers as used for X-ray Purposes." Major C. E. S. Phillips, O.B.E., "The Problem of Interrupted and Fluctuating Currents." R. S. Wright, "High-Tension Transformers." Joint meeting with the Röntgen Society and the Electro-Therapeutic Section of the Royal Society of Medicine.

(At the Royal Society of Medicine, Wimpole Street, W., 5 to 6.45 p.m., and 8.15 to 10 p.m.).

March 4th.—Annual dinner. At the Connaught Rooms (7 for 7.30 p.m.).

WIRELESS SECTIONAL MEETINGS.

February 18th and March 17th.—To be announced later.

INFORMAL MEETINGS.

February 2nd.—Major T. Rich, O.B.E., "Engineering Experiences during the War."

February 16th.—A. B. Eason, "Automatic Telephony for Private Branch Exchanges."

March 1st.—R. E. Dickinson, "The Future of Labour in the Engineering Industry."

March 15th.—J. W. Beauchamp and S. M. Hills, "Industrial Electric Heating."

March 29th.—To be announced later.

April 19th.—G. H. Ayres, "Group *v.* Individual Driving."

MEETINGS OF TERRITORIAL CENTRES.

North-Eastern Centre.

January 26th.—J. Shepherd, "Failures of Turbo-Generators and Suggestions for Improvements."

February 9th.—J. L. Thompson, "Transformers for Electric Furnaces."

February 23rd.—L. H. A. Carr, "Some Magnetic Problems." (Lecture).

North Midland Centre.

February 10th.—E. Cross, "The Rotherham Power Station."

March 9th.—To be announced later.

March 23rd.—To be announced later. Joint meeting with the Association of Mining Electrical Engineers.

North-Western Centre.

January 27th.—J. L. Thompson, "Transformers for Electric Furnaces."

February 10th.—Lieut.-Col. F. C. Aldous, D.S.O., and A. E. Leigh Scanes, M.A., "A Critical Survey of Power Supply in the Rhine Valley."

February 24th.—Informal discussion on "Electricity Supply Tariffs."

Scottish Centre.

February 10th.—J. L. Thompson, "Transformers for Electric Furnaces."

March 9th.—Major K. Edgcumbe, R.E. (T.), "The Protection of Alternating-Current Distribution Systems without the use of Special Conductors."

South Midland Centre.

January 28th.—J. Shepherd, "Failures of Turbo-Generators and Suggestions for Improvements."

February 11th.—Informal discussion on B.E.S.A. Specification No. 72.

Western Centre.

February 2nd.—To be announced later.

March 1st.—Prof. D. Robertson, "Electric Clocks."

April 5th.—Prof. F. Bacon, "Thermionic Valves."

Association of Mining Electrical Engineers.—At the monthly meeting of the Yorkshire branch of this Association, held at Leeds on January 9th, a paper by Mr. Idris Jones, of the South Wales branch, on "Practical Mining Electrical Notes" was read by the president, Mr. R. Holiday. The notes, originally read at Bargoed in March last, were of a technical nature, and had particular reference to points which arise on E.H.T., A.C. systems in collieries, which are linked up and working in parallel. The items specifically dealt with were load and voltage adjustments, increased forces under fault conditions, and the earthed neutral. The president observed that as yet few members in the West Riding had had actual experience of E.H.T. plant, though several were working in the South Yorkshire coalfield.

Faraday Society.—The symposium organised by the president, Sir Robert Hadfield, on Wednesday last week, was highly successful. The exhibition of microscopes and specimens was exceptionally interesting, and valuable information was contained in the papers that were read. Sir Robert, who presided, and afterwards entertained 150 guests at dinner, pointed out the backward state of the British optical industry at the outbreak of war, and the importance of ensuring that such a condition should not recur. All the requirements could be met by the Anglo-Saxon in the near future.

Liverpool Engineering Society.—The society's annual dinner is to be held at the Exchange Station Hotel, Liverpool, at 7.30 p.m., Thursday, February 12th.

National Association of Supervising Electricians.—On Saturday last the annual dinner of the Association was held at the Holborn Restaurant; the President, Mr. J. S. Highfield, presided, and there were 114 guests. The toast of "The King" was given by the President before the sorbet, and at a later stage Mr. A. W. Beaver proposed the health of "The Association," which, he said, was formed in 1914 mainly for educational purposes, but was registered as a Trade Union in 1918, in order to secure representation on the Whitley Councils; however, owing to the veto of the Electrical Trades Union, the Association was not admitted to the Federation, and therefore was not represented at the Trade Union Congress. The Congress was the loser, for the Association represented the brains of the contracting industry. Mr. R. W. Whitley, chairman of the Council, in reply, said that the Association was the finest of its kind, but ought to be more "pushful," and concluded by reading amusing letters which he had not received from distinguished statesmen. Mr. W. J. Revell, in proposing "The President," said that to know him was to love him, and congratulated the Association on his consenting to retain the post for another year. Mr. Highfield, in responding, expressed his pleasure and pride on being invited to be President for a third year; he said the Association had had chequered times in the past, and was likely to have more in the future, but he was certain that out of the chaos created by the war, would be built the finest Empire that had ever been. The prestige of this country had never stood so high, and it was their duty to light the way for the peoples of the world. They could do that by work, but they ought also to laugh—laughter was better than all the arguments in the world. Mr. C. J. Banister proposed "Kindred Associations," with which, he said, the N.A.S.E. was on very amicable terms; it had recently been affiliated to the Federation of Scientific and Technical Societies, which would help it to secure representation on the Whitley Councils. Mr. W. A. Jones responded, and referred to a proposal to form another Federation which would shortly come before the Association, and which would require careful consideration. Hitherto they had met with some opposition, but that was dwindling, and the Labour Unions were recognising the value of the technical men. Mr. Perks proposed "The Press," for which Mr. A. H. Allen responded, and finally Mr. S. P. Ives gave the toast of "The Visitors," which was acknowledged by Mr. Hogan. A musical programme was provided, in which Mr. Jock Walker was especially successful, and the function was thoroughly enjoyed by the members and their guests.

Institution of Post Office Electrical Engineers.—At the annual meeting of the London Centre of this Institution, held on January 19th, at the Royal Society of Arts, the way in which telephone and telegraph communication was kept up between G.H.Q. and the British Armies, corps, and divisions in France was described. Major H. Brown, who was in charge of the work, explained how what he called the Victory line to Germany was constructed. Whenever there was a forward movement, the Signalling Service was responsible for keeping up communications with the Commander-in-Chief's train close to the fighting units. On the morning of the Armistice an order was received from headquarters: "We want 16 wires to the Rhine; get on with it at once." Arrangements were made that night for sending 400 extra men belonging to telegraphic construction companies to assist in the work, together with the requisite stores, transport, and two Pontoon Parks, consisting of 28 four-wheeled drive lorries and 56 trailers, which were very hard to get started and very difficult to stop when once they did start. Lantern slides were exhibited by Major Turner illustrating the methods by which wire signalling was carried on in the Hellas section of the Gallipoli Peninsula, and Captain Read described the work of laying buried cables in order to avoid damage from shell fire.

Edinburgh Electrical Society.—There was a large attendance of members on Wednesday, 14th inst., to hear a lecture on "Anti-Submarine Defence," by Mr. B. Stark. The lecturer sketched the numerous inventions which were first hurriedly evolved to deal with the menace. He gave interesting particulars of the very perfect electrical locating devices which were finally and effectively applied.

The next meeting of the Society will take place in the Philosophical Institution at 8 p.m. on Wednesday, 28th inst., when there will be a discussion on the newly-issued "Regulations for the Electrical Equipment of Ships." The discussion will be introduced by Mr. D. S. Munro.

The syllabus of this society includes the following :—

February 11th. "Petrol Gas Plant for Electrical Engineers," by Mr. G. Plucknett.

February 25th. "Electric Projectors and some of their Uses," with lantern illustrations, by Mr. Alex. Ogilvie, B.Sc.

March 10th. Questions and Answers Night.

March 24th. Visit to Telephone Exchange, Rose Street.

April 7th. Apprentices' Night; short papers on every-day work for Society's prize.

April 21st. "The Telephone," by J. M'Ewan Brown.

April 24th. Visit to Bruce Peebles's Works.

May 12th. Annual General Meeting.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. S. PARSONS, foreman at the Ramsbottom tramways depôt, has been appointed to succeed Mr. J. Wild as manager of the Ramsbottom (Lancs.) U.D.C. tramways.

Messrs. S. C. BARTHOLOMEW and R. M. HOOK, assistant engineers in the engineering department of the G.P.O., have been appointed executive engineers.

The King has conferred the Territorial decoration on the following officers of the London Electrical Engineers: Capt. C. H. R. THORN, M.I.E.E., and Capt. F. H. MASTERS, M.I.E.E.

On leaving Wigan to take up the position of tramways manager at Bury, Mr. F. BUCKLEY, who was formerly tramways manager at Wigan, has been presented with a case of cutlery by the Corporation officials.

The marriage took place on January 12th, at St. Mark's, North Audley Street, of Mr. F. G. BYNG, fourth son of the late Mr. G. Byng, to Madeleine, only daughter of the late Harold Drory and Madame Drory, of Ghent, and Brussels.

Congratulations to Mr. W. V. BALL, O.B.E., one of our esteemed contributors, on his appointment as Assistant Recorder of Leeds.

Corporal (Acting-Sergt.) J. H. POTTERTON, Rifle Brigade, who is now in Spain engaged in the erection of engineering plant for the British Thomson-Houston Co., Ltd., has been mentioned in despatches by Sir Douglas Haig for gallant and distinguished service in the field.

Mr. E. G. BOWERS, M.C., A.M.I.E.E., is leaving the employment of the Glasgow Corporation Electricity Department to take up the position of electrical engineer to Messrs. Bruntons, of Musselburgh.

Mr. A. B. MALLINSON, M.I.Mech.E., has now ceased to act as chief engineer to the group of paper mills controlled from 44, King Street, Manchester. For the present he will carry on his consulting practice from Worsley Street, Salford.

The *Times* states under University Intelligence (Cambridge) that Prof. Sir JOSEPH LARMOR, M.P., Prof. Sir J. J. THOMSON, and Prof. ERNEST RUTHERFORD are among those who have consented to serve as representatives of the University on a joint committee of the Royal Society and the University for the purpose of taking steps to secure an appropriate memorial to the late Lord Rayleigh.

Obituary.—MR. H. T. WAKEMAN.—We regret to record the death of Mr. H. T. Wakeman, surveyor and engineer for the County of Middlesex, which occurred on Sunday night, he having taken hydrochloric acid in mistake for medicine.

The late Dr. C. A. MERCIER, of Bournemouth, left £4,829.

NEW COMPANIES REGISTERED.

English Electric Supplies, Ltd. (162,609).—Private company. Registered January 9th. Capital, £50,000 in £1 shares. To take over the business of the Britannia Lamp and Accessories Co., Ltd., &c. The subscribers (each with one share) are: G. Dickson, 4, London Road, South Benfleet, clerk; F. D. Billett, 7, Trinity Square, Brixton, S.W., clerk. The subscribers are to appoint the first directors. Solicitors: Linklater & Paines, 2, Bond Court, Walbrook, E.C.

Barrett & Wright, Ltd. (162,602).—Private company. Registered January 9th. Capital, £13,000 in £1 shares. To take over the business carried on at 19, Bartholomew Close, E.C., and elsewhere, as "Barrett & Wright," and to carry on the business of electrical and mechanical engineers, manufacturers of and dealers in heating and ventilating machinery, &c. The first directors are: J. Barrett, 5, Woodside Road, Wood Green, N.; R. F. Wright, "Elmhurst," Cavershanf Avenue, Palmer's Green, N.13. Registered office: 19, Bartholomew Close, E.C.

Oliver Engineering Co., Ltd. (162,770).—Private company. Registered January 13th. Capital, £2,000 in £1 shares. To take over the business of mechanical and electrical engineers and general metal workers carried on by A. H. Oliver and J. O. Dunbabin at 9, Fenchurch Buildings, E.C., as "Oliver & Dunbabin." The first directors are: A. H. Oliver, Campsie, South Avenue, Southchurch, Essex; J. Sulch, 107, Blackhouse Road, Fartown, Huddersfield; F. Lavy, 74, Torbay Road, Brondesbury, N.W.; J. O. Dunbabin, 11, Como Road, Forest Hill, S.E. Registered office: 9, Fenchurch Street, E.C.

Automobile Electrical Repairers, Ltd. (162,841).—Private company. Registered January 15th. Capital, £1,000 in £1 shares. To carry on the business of electrical and mechanical engineers, &c. The first directors are: P. Goldstein, 190, Lordship Road, N.16, engineer; C. F. Collins, 12, Alexandra Road, Southall, electrical engineer. Solicitor: A. Carter, Bedford Row House, W.C. Registered office: 400 Euston Road, N.W.

Telephone and Microphone Co., Ltd. (162,831).—Private company. Registered January 14th. Capital, £10,000 in £1 shares (5,000 cumulative participating preference). To carry on the business indicated by the title. The first directors are: R. Scruby, The Oaks, Benhill Wood Road, Sutton, Surrey; J. R. Scruby, Graigaure, Benhilton, Sutton, Surrey. Solicitors: Rollit, Sons & Compton, 5, Mincing Lane, E.C. Registered office: Throwley Road, Sutton, Surrey.

Renew Lamp Co. (Eastern), Ltd. (162,824).—Private company. Registered January 14th. Capital, £5,000 in £1 shares. To carry on the business of refillers of incandescent electric lamps, &c., and to enter into an agreement with Aladdin Renew Electric Lamp Corporation, Ltd., and J. M. Moore, D.Sc. The first directors are: J. M. Moore, 31-3, High Holborn, W.C.; E. S. Saunders, 69, Linden Gardens, W.; J. S. W. Milne, 3-4, Great Winchester Street, E.C. Qualification, £100. Registered office: 3-4, Great Winchester Street, E.C.

Hart Collins, Ltd. (162,680).—Private company. Registered January 10th. Capital, £5,000 in £1 shares. To take over the business of Cyril Hart Collins, and to carry on the business of manufacturers of and dealers in motor cars, manufacturers of electrical appliances, motor, electrical and general engineers, &c. The subscribers (each with one share) are: C. Hart Collins, 39, Mayflower Road, Clapham, S.W.9, motor engineer; Mrs. H. M. Collins, 39, Mayflower Road, Clapham, S.W.9. The first directors are: C. Hart Collins (managing director) and Mrs. H. M. Collins. Registered office: 5, Bessborough Mews, Bessborough Street, Westminster, S.W.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Litholite Insulators, Ltd.—Satisfaction registered December 2nd, 1919, of all moneys due under charge registered March, 1911. Land registry charge on 57, Hackney Green, Hackney, registered December 2nd, 1919, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Hall & Towns Instrument Co., Ltd.—Debentures for £250, registered November 29th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Lancashire Electrical Engineering Co., Ltd.—Satisfaction registered December 13th, 1919, of charge for £200, registered September 5th, 1917.

Power Engineering Co., Ltd.—Mortgage on land at Westinghouse Road, Trafford Park, Stretford, with buildings, plant, &c., thereon, registered December 4th, 1919, to secure £6,000. Holders: McKechnie Brothers, Ltd., Rotton Park Street, Birmingham.

CITY NOTES.

German Companies.

The report of the *Deutsch-Ueberseeische Elektrizitats Gesellschaft, of Berlin*, whose financial results for the past two years have already been reported (no dividend on the ordinary shares) states that the supply works at Buenos Ayres suffered from an increased extent in 1918 from the effects of the Black List, whilst the difficulties in the supply of coal were greater than in the preceding year. The cost of fuel per kilowatt-hour sold amounted to 0.04 marks in 1914, 0.10 marks in 1916, 0.14 marks in 1917, and almost 0.22 marks in 1918, and the Buenos Ayres undertaking was worked at a loss, coal having been the determining factor in this direction. Concerning the Chilean Electric Tramway & Light Co., the report states that no information had come to hand as to the working results in 1918. The Board of Trade in England had offered for sale the company's holding of ordinary and preference shares, but nothing was known respecting the conclusion of the transaction. An English management had been appointed at Santiago, and had made a legal claim on the German company for the repayment of 16,530,000 Chilean gold pesos, which had been remitted to the latter.

The report of the *Elektrizitats A.G. vorm. Schuckert & Co., of Nuremburg*, whose accounts for 1918-19 were summarised two or three weeks ago, states that the supply works and tramways suffered more seriously than hitherto as a consequence of the effects of the lost war, and the revolution. The possibilities for the construction and working of lighting works and tramways in other countries were closed to German firms for the immediate future. On the other hand, the spirit of enterprise at home was paralysed by the electricity and municipalisation laws coming into existence. The problem therefore arose for extending the scope of activity to new branches; the company made preparations some time ago for this partial transposition, and had entered into relations in various directions which promised to lead to further favourable development. In the case of the foreign investments at Trieste, Petrograd, Barcelona, and Paris, the report mentions that the guiding lines for the settlement of these participations were given in the Treaty of Peace. The company hoped in conjunction with the Siemens-Schuckert works to share in the construction of the Bavarian hydro-electric works which the State of Bavaria had now decided to erect as a State undertaking, and also in the establishment of the works on the Isar.

The report of the directors of *Siemens & Halske, A.G., of Berlin*, for 1918-19 states that only 70 per cent. of the possible working hours was worked by the men after the revolution and the introduction of the eight-hour day. As a consequence the change over from war to peace work was considerably delayed, and it was only possible to satisfy a small portion of the great demand for the company's manufactures both at home and abroad. The conclusion of contracts with long periods for delivery was rendered difficult, particularly abroad, by the fluctuations in German exchange, and the uncertainty in the calculation of the costs of production. The activity of the leading officials was largely withdrawn from productive work by worrying negotiations. The number of workers was increased in the first part of the financial year, but subsequently receded to the former peace-time level; and the number of hours worked declined from 120,000,000 in 1917-18 to 78,500,000 hours last year. Nevertheless the company's expenses for wages and salaries, and those of the Siemens-Schuckert Works rose from 208,000,000 marks in 1917-18 to 254,000,000 marks last year; and these expenses were in course of permanent increase in the new financial year. The gross profits are returned at 15,736,000 marks for

1918-19, and the net profits at 11,457,000 marks, these comparing with 17,750,000 marks and 13,954,000 marks in the preceding years respectively. It is proposed to pay a dividend at the rate of 12 per cent., being the same rate as in 1917-18. The report states that it cannot be foreseen what development the works will take as a consequence of the Treaty of Peace, the taxation burdens, and the impending legal regulation of labour conditions; but serious times are pending for German industry.

Chatham & District Light Railways Co.—Revenue for the year 1919, £78,840; expenses, £52,615. Rent of Rochester Corporation lines £3,744, interest account £2,172, to reserve for depreciation £6,000. Including the balance brought forward (£3,802), the balance is £18,061. After paying 5 per cent. preference dividend and 4 per cent. on the ordinary shares, £308 is voted to the directors and £3,393 is carried forward. As compared with 1918 there was an increase of £11,497 in revenue and £14,069 in expenses. £3,394 was expended on deferred repairs. Passengers carried 16,197,991, against 14,015,124. Car mileage 979,983, against 790,799.

Liverpool Overhead Railway Co.—Final dividends at the rate of 5 per cent. per annum (less income tax) on the preference shares, and 4 per cent. per annum (less income tax) on the ordinary shares, making 5 per cent. on the preference shares and 3¼ per cent. on the ordinary shares for the year. Meeting, February 24th.

Electrical Utilities Co.—Quarterly dividend of 1¼ per cent. on Preference stock.

Shanghai Electric Construction Co., Ltd.—Second interim dividend at rate of 6 per cent. actual (12s. per share), less tax, in respect of year 1919.

Greenwood & Batley, Ltd.—Interim dividend of 5 per cent. on the ordinary shares.

Montreal Companies.—Quarterly dividends of 1¼ per cent. on the Montreal Light, Heat and Power Consolidated Co. and 2 per cent. on the Montreal Light Heat and Power Co.

STOCKS AND SHARES.

TUESDAY EVENING.

THE Stock Exchange is certainly having the time of its present life. Business does not roll, it pours, into industrials. Nor are gilt-edged issues neglected. Substantial premiums have been established upon various new Colonials, and this has its effect in stiffening purely investment stocks in other markets. The favourable influence produced upon Russian descriptions by the suggested raising of the blockade is another factor in the general situation. In the mining sections, the prices of base-metal shares are better. The rubber market is quiet, its claims overshadowed by the potency of the spell cast by the oil boom over imagination and money.

Mexican affairs are amongst the few disappointments of to-day's markets. Prices were suddenly rushed up a fortnight ago, certainly on flimsy grounds, but with hopefulness eagerly expectant of early return from chaos to order in the country. And nothing has happened. The consequence is that prices are subsiding—rapidly as regards the railways, in more dignified fashion amongst the Utilities. In fact, the reaction in such issues as Mexico Tramways, Mexican Light and Power, Monterey, Pachuca and others of similar character has been very trifling compared not only with the previous rises but also with the setback in Mexican Railway stocks. It is evident that proprietors of the Utility Companies are ready to keep their stocks until such time arrives as will indeed bring peace to Mexico.

British Columbia Electrics are rather better, but the main feature in this department is the further improvement in Anglo-Argentine Tramways. Upon the comments made here last week with reference to the effect which the fare-raising should have on the dividend arrears, the first preference advanced to 4¼, seconds to 3¼, while the 5 per cent. debenture stock rose a point to 65¼. This last-named may now be considered a sound investment security of the second rank, and it is not surprising that stock should be none too easy to buy. Brazilian Tractions are easier at 59. No particular recovery can be expected here so long as the possibilities of early German sales are worrying the market. Brazil is going ahead rapidly, but Germany and Austria both held Brazilian issues before the war, and the Stock Exchange looks for sales of such securities as soon as international freedom of financial business is restored to pre-war conditions.

The market for electricity supply shares is steady enough, but there is not much change. Metropolitans continue to improve, and at 3 3-16 show 1-16 rise, though on the other hand South Londons at 2⅜ are equally lower. The tendency to exchange from preference shares into ordinary and therefore more speculative issues, continues to be one of the features in the Stock Exchange. This may explain a drop in County preference. Shares changed hands the other day at 8¼, and the nominal price is 8⅜ middle. Considerable activity prevails in Edisons. It is said that some good news or other is on the point of being published which will have the effect of putting up the shares to 30s. at least, but there is no official information so far.

Manufacturing shares as a whole are quite a good market. Callenders are throwing off their recent weakness, and after their jump of 7s. 6d. last week have advanced another 10s. British Insulated at 2 3-16 are ¼ higher. Electric Constructions at 1 3-16 are also up half a crown. A further rise carried Siemens to 30s., so that anyone who has bought either Siemens, Edisons, or British Insulated on recommendations given here from time to time is not likely to be dissatisfied with the present position of his stocks. Nor does there seem to be any particular hurry to sell unless the holder thinks he sees something more attractive elsewhere. It must be borne in mind that this is the day of big combines, and that the shares of any company likely to form a partner in amalgamation schemes can be held with tolerable assurance of improvement in value. British Aluminiums at 35s. are slightly lower. General Electric preference shed 6d., which was picked up by the ordinary—another minor illustration of the trend of investment nowadays.

The railway market is better, though confidence declines to support stocks to any great extent. Underground Electric income bonds have regained 2½ points. Metropolitans are also stronger, but there is no movement in the other electrical railway issues.

Apart from ex dividend markings, the prices of telegraph and telephone shares exhibit little change on the week. There is a dullish tone about the Marconi group, the parent shares being ¼ down, and other declines leaving Marconi Marines 2⅛, Canadians 13s., and Americans 30s. 3d. The market is out of fashion for the time being, and rumours lately current with reference to possible agreement-of-interest schemes between some of the subsidiaries have been allowed to fade away, so far as market influence is concerned. Automatic Telephones, too, are quieter, the price remaining about 35s. The rubber share market, as already indicated, fails to make headway against the superior attractions offered to the speculative mind by the vitality of the oil list.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Jan. 20, 1920.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	8½	—	£6 16 2
Charing Cross Ordinary	4	4	3	—	6 13 4
do. do. do 4½ Pref.	4½	4½	9⅛	—	8 8 8
Chelsea	5	3	3	—	5 0 0
City of London	8	8	18	—	8 8 1
do. do. 6 per cent. Pref.	6	6	9¾	—	6 6 4
County of London	7	7	9⅝	—	7 9 4
do do. 6 per cent. Pref.	6	6	8⅞	—¼	6 15 2
Kensington Ordinary	7	6	4⅝	—	8 8 4
London Electric	Nil	Nil	1⅜	—	
do. do. 6 per cent. Pref.	5	6	8⅜	—	8 17 10
Metropolitan	4	5	3 3/16	+ 1/16	7 16 10
do. 4½ per cent. Pref.	4½	4½	2⅛	—	7 16 6
St. James' and Pall Mall	9	10	6	—	8 6 8
South London	5	5	2 5/16	— 1/16	7 12 8
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	8½	—	7 12 5
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	86½xd	—	6 14 1
do. Def.	1½	80/6	21½xd	—	7 1 2
Chile Telephone	8	8	6½xd	—	6 8 0
Cuba Sub. Ord.	7	7	10⅝	—	*6 18 4
Eastern Extension	8	8	15½xd	—	*5 0 10
Eastern Tel. Ord.	8	8	164¼xd	—	*4 17 3
Globe Tel. and T. Ord.	7	8	16⅜	—	*4 19 3
do. do. Pref.	6	6	9⅞	—	6 3 1
Great Northern Tel.	22	22	23½	—	9 7 2
Indo-European	13	13	48½	—	6 13 4
Marconi	20	25	4⅞	— ¼	5 19 4
Oriental Telephone Ord.	15	10	2⅝	+ 1/16	4 11 6
United R. Plate Tel.	8	8	7⅛	+ 1/16	*5 8 8
West India and Panama	1/8	1/8	1⅛	+ 1/16	Nil
Western Telegraph	8	8	17	—	*4 14 2
HOME RAILS.					
Central London Ord. Assented	4	4	58½	—	6 16 9
Metropolitan	1	1½	25½	+ ½	4 18 6
do. District	Nil	Nil	21	—	Nil
Underground Electric Ordinary	Nil	Nil	2⅛	—	Nil
do. do. "A"	Nil	Nil	7/6	—	Nil
do. do. Income	4	5	86½	+2½	*5 15 7
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	87	—	7 14 10
Anglo-Arg. Trams. First Pref.	8½	Nil	4½	+ ½	—
do. do. 2nd Pref.	—	—	8⅛	+ ½	—
do. do. 5 Deb.	5	5	65½	+1	7 12 8
Brazil Tractions	—	—	59	—1	—
Bombay Electric Pref.	6	6	13⅜	+ ½	4 7 3
British Columbia Elec. Ry. Pfce.	5	5	60¼xd	—	8 5 4
do. do. Preferrred	Nil	2½	56⅛	—	4 8 9
do. do. Deferred	Nil	Nil	52½	—	Nil
do. do. Deb.	4½	4½	64	—1	6 15 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	46	—	Nil
do. 6 per cent. Bonds	Nil	Nil	35½	—1	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	35	—	Nil
do. 1st Bonds	Nil	Nil	86	—2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3⅜	—	*4 9 0
British Aluminium Ord.	10	10	1⅞	— 1/16	5 14 3
British Insulated Ord.	25	19½	2 3/16	+ ¼	5 14 2
Callenders	25	25	9⅛	+ ⅛	6 17 0
" 6½ Pref.	5	6½	4⅞	—	7 2 1
Castner-Kellner	25	20	3⅞	—	3 15 7
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	10	1⅞	+ 1/16	7 5 0
do. do. 5 per cent. Deb.	4	5	79½	—	6 5 9
Electric Construction	10	10	1⅞	—	8 8 8
Gen. Elec. Pref.	6	6⅔	19/-	—	6 12 6
do. Ord.	10	10	42/-	+1/-	*4 15 3
Henley	25	25	2½	—	5 11 1
do. 4½ Pref.	4½	4½	3⅜	—	6 4 2
India-Rubber	10	10	16	—	*6 5 0
Met.-Vickers Pref.	—	—	94½	—	5 14 0
Siemens Ord.	—	10	30/-	+1/6	*6 13 4
Telegraph Con.	20	20	36½	—	*4 10 6

* Dividends paid free of Income Tax.

THE PHYSICAL SOCIETY'S EXHIBITION.

(*Continued from page* 90.)

The Zenith Manufacturing Co. showed a variety of regulating resistances and rheostats, of the slate and tubular patterns, for use in test rooms and laboratories; these were of improved design, particularly in respect of the arrangement of the end supports and the method of clamping the wire. The support is provided with a clamping ring which

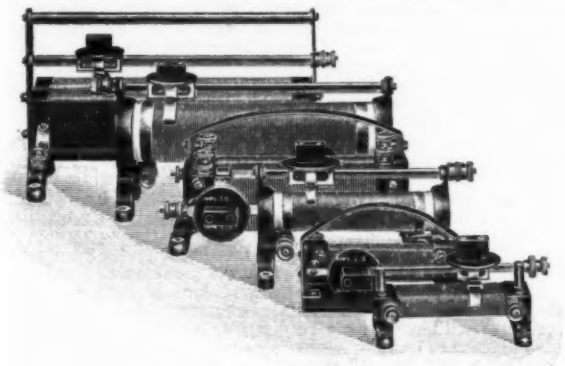


Fig. 5.—Zenith Rheostats.

automatically fits the tube, a recess which prevents end movement, and a projecting lug which definitely anchors the band which surrounds the end turns of the wire, besides rigidly supporting the terminal, and thus making a sound mechanical job. A group of rheostats, of the cruciform and square slate and enamelled-iron tube pattern, is shown in fig. 5.

Another exhibit was an improved type of magnetic vibratory rectifier, suitable for small outputs (up to 75 watts), for charging small lighting and starting battery equipments

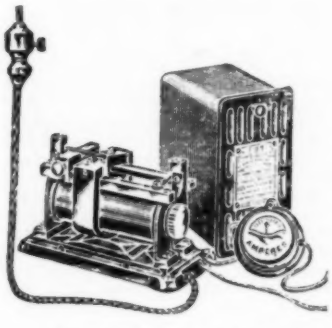


Fig. 6.—Vibrating Rectifier, with Cover Removed.

from A.C. circuits. By the aid of a permanent magnet, the reed is set in synchronous vibration, adjustment being provided to tune the reed; adjustable carbon contacts are fitted, and both half-waves are utilised. The device, which is shown in fig. 6, can be connected to a lamp holder, and needs no attention.

Messrs. Edison Swan Electric Co., Ltd., had on view a series of service valves for wireless reception and transmission, including Marconi valves made by the firm of the V24, Q, Round, and other types of receiving valves, as well as three types of transmitting valves. Scott Taggart-Ediswan double-anode, full-wave rectifying valves for low and high powers, also a continuous wave transmitting valve for use with alternating current without separate rectifiers were to be seen. A high-power rectifying valve for passing heavy currents at low anode potentials which, it is claimed, will pass twice the energy of ordinary rectifiers having the same size of bulb was also exhibited, while in conjunction with Mr. H. W. Sullivan, a receiving set was installed and shown in working order. Finally, a selection of various sizes of tungsten-arc, gas-filled Pointolite lamps, as recently described in our pages, was on view, some of the smaller sizes being alight to demonstrate the method of striking the arc on switching on the lamp.

Messrs. Nalder Bros. & Thompson's exhibit included the "Ohmer," the N.C.S. dead-beat moving-coil paralleling voltmeter, a portable testing set, and a portable sub-standard instrument. The voltmeter shows the difference between the busbar voltage and that of the incoming dynamo, and by means of a key the sensibility can be increased ten-fold, so that great accuracy is attained at the critical moment. The portable testing set comprises two dead-beat m.c. instruments mounted in the same case, together with ammeter shunts and voltmeter resistances, the combination being designed to secure speed and accuracy of measurement, with the maximum convenience in connecting up. The portable substandard is a high-class m.c. instrument in an aluminium case, and is built in accordance with the specification of the British Engineering Standards Association for sub-standard accuracy.

The High Tension Co. exhibited a selection of some of the apparatus it manufactures; for instance, there were to be seen 0.5 and 1.5-kw. transformers and 10-in. induction coils for wireless purposes, as well as a 16-in. coil of improved design with interruption for X-ray and general purposes. This firm prefers to design each coil for the particular purpose for which it is used, and regards them as commercial transformers of energy, and they are, therefore, not labelled with fancy names. If required statements of output and oscillograms of wave form are supplied. All coils are designed to work normally with a frequency of interruption of 50 breaks per second, the time economy being 0.5, that is, when the period of make equals the period of break. An entire absence of inverse is claimed unless the coil is pushed to its extreme limit. The secondaries of all coils are wound by hand and insulated by a patented method; any coil can be insulated with special high melting point wax, such as is demanded for use by the Indian Government, without extra cost. A high-tension transformer suitable for wireless, spectroscopy, diathermy, or testing is shown in fig. 7, while the M.I.R.A. motor-driven turbine interrupter shown in fig. 8 embodies several new features. Being driven from beneath, the jet cone and contact segments are easily accessible by simply raising the lid, which may be of glass through which to view the apparatus while running. The jet cone can be removed at once by unscrewing the milled headed screw holding it in position. The ratio of make to break can be varied by turning the exterior milled ebonite head. The frequency of interruption can be increased from 1 to 80 per

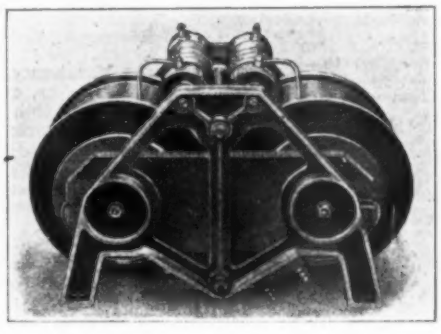


Fig. 7.—High-tension Transformer.

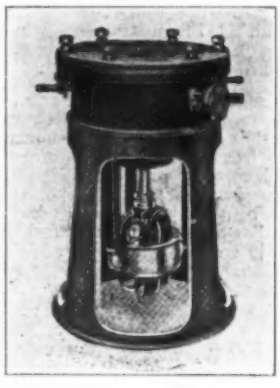


Fig. 8.—Motor-driven Turbine Interrupter.

second with the two-segment, or from 2 to 160 with the four-contact type of apparatus. The maximum current passed should not exceed 40 amperes, but over half this amount may be passed for hours without overheating the break.

The Weston Electrical Instrument Co., Ltd., had a varied show of its well-known standard and portable instruments—ammeters, voltmeters, wattmeters, &c.—in a variety of sizes and patterns. A millivoltmeter of the moving-coil type is designed for use with a standard thermo-couple, giving a full scale deflection with 18 millivolts; a rheostat for compensating for the resistance of the thermo-couple is provided, to keep the total resistance of the circuit constant. The scale can be calibrated in degrees of temperature, F. or C., in addition to the millivolt scale. The combination can be used for any purpose for which an ordinary thermometer is used.

A novel instrument that was shown was the direct-reading microfaradmeter, a type of meter that we had not previously met with; for quickly measuring the capacities of condensers, cables, aerials, &c., this device will have a wide field of utility. It is made for various frequencies and voltages, but is unaffected by wide variations of these factors from the normal. The moving system of the instrument consists of two moving coils wound upon the same staff, and two field coils arranged somewhat similar to a Weston power-factor meter. The instrument also contains a standard condenser and binding posts to which the unknown condenser is to be connected. The current through the standard condenser passes through both moving coils, and also the field coils, thus causing the pointer to deflect 45 deg. to the left of the position shown in fig. 9, or on to the zero of the scale,

when an unknown condenser is not connected to the instrument. When a condenser is connected to the terminals marked x, the current through it also traverses one winding of the moving coil, and also the fields of the instrument, thus causing the pointer to deflect to the right. The constants of the instrument are so arranged that the ratio of the two currents flowing through the standard and the unknown condenser is substantially the same for any frequency and voltage over fairly wide limits, but for highly accurate work the voltage should not vary more than 15 per cent. above or below normal, or the frequency more than 10 per cent. As

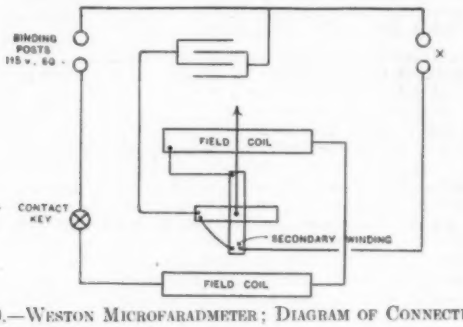


FIG. 9.—WESTON MICROFARADMETER; DIAGRAM OF CONNECTIONS.

the instrument has no springs or similar controlling device the position of the pointer must depend solely upon the ratio of the currents through the two circuits of the movable system, and as this ratio depends solely upon the capacity of the unknown condenser, the instrument must accurately measure that capacity, and is guaranteed to do so within ½ per cent. of the maximum scale reading. Being air-damped, the pointer quickly comes to rest, so that measurements may be made with the same speed and facility as with other Weston measuring instruments. Indeed, with the microfaradmeter a large number of condensers may be measured in rapid succession, in the same manner as dry cells may be tested with a cell-testing voltmeter.

A resistance (not shown in the sketch) is included in the circuit of the instrument, which will prevent an excessive amount of current passing through it in case the binding posts marked x are short-circuited.

MESSRS. ISENTHAL & CO., LTD., showed rheostats of the slider pattern and multiple-stud types, including the new "Post-multiple-stud types was shown, including the new "Post-war" designs. A new feature was the "Phantom" wireless condenser—a variable condenser with a coarse and a fine adjustment, reading directly in wave-lengths with the aid of a vernier, to an accuracy of 1 in 1,000. An auxiliary or "phantom" condenser is embodied in the instrument, which is set to correct for "plate-end" and leakage capacity in the instrument itself, and a simple adjustment is provided for com-

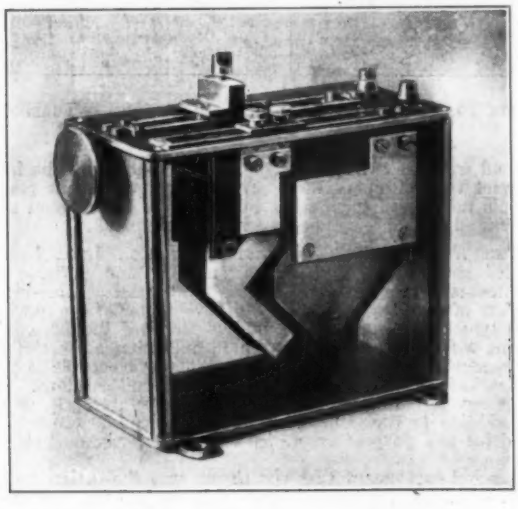


FIG. 10.—ISENTHAL "PHANTOM" CONDENSER.

pensating for the effective capacity of the circuit in which it is used. The instrument (fig. 10) is of the rectilinear sliding type, very accurately made and finished, and is (normally) electro-statically screened by completely enclosing the plates in a metal case, the moving sets of plates being connected permanently to the box. By connecting the moving plates to the screen, capacitance from one set of plates to the other through the screening medium is made a constant quantity, and can be corrected by a permanent adjustment. Error due to the linking electrostatic field between the outside plates is reduced to a negligible quantity by employing a total plate area which is large compared with the area of a single plate. Another error due to additional capacity introduced by the plate edges is reduced to a minimum by the use of extremely thin metal plates, and by the fact that, owing to the shape of the plates, the edge area is always maintained small in relation to the effective capacity of the instrument on any setting. The main and small "phantom" condensers are both variable and connected in parallel. The main condenser plates are square except for one corner of each, a small portion of which is cut off transversely to the diagonal. The plates are mounted so as to be adjustable along their concurrent diagonals, so that their area, and capacity, vary according to the square of the distance traversed by the moving plates, plus a constant due to leakage, and minus the absent area due to the portions cut away. The auxiliary condenser is normally set to correspond with the "absent" area, minus an area representing a capacity equivalent to the resultant leakage effect. After this adjustment has been made the effective capacity of the instrument varies accurately according to the square of the relative traverse of the plates along their diagonal. Square plates traversed diagonally were originally proposed by Tissot. When the instrument is connected to an oscillatory circuit, a small subtractive adjustment is made with the "phantom" plates in order to compensate for the distributed capacity of the coil or coils of the circuit, and the accuracy of the scale is thereby maintained under any conditions of service. Tests made by the National Physical Laboratory give a straight line curve with main scale readings as abscissæ and capacity wave lengths as ordinates. In future instruments the "phantom" scale will be calibrated in micro-microfarads, the scale readings corresponding to the distributed capacity in whatever circuit it is intended to use the instrument in. Once this capacity has been determined, it is only necessary to set the "phantom" pointer to the value obtained. In a series of trials on various wave lengths the actual decrement in a wavemeter due to the present condenser was so small that it was difficult to obtain a reliable series of figures.

(To be continued.)

SCIENTIFIC MANAGEMENT: A SOLUTION OF THE CAPITAL AND LABOUR PROBLEM.

DISCUSSION AT MANCHESTER.

AT Manchester, on December 16th, Capt. J. M. Scott-Maxwell's paper, an abstract of which appeared in our issues of December 19th and 26th last, was read, and discussed by the NORTH-WESTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS.

Mr. H. MENSFORTH disagreed with many opinions expressed in the paper. Science was not going to put industry right. What had been lacking in the past was humanity, and so far as he had read Dr. Taylor's writings on scientific management there was a lack of humanity through them all. The human element must come before any system. Dr. Taylor said that the principal object of scientific management was to produce the greatest prosperity for the employer and the employé. There was another thing that he should have included: it must be to the common good of the community. The whole idea at the back of Dr. Taylor's mind was to set up task work, and however successful he might have been in the States, he (the speaker) did not think scientific management could be established here on those lines. Such schemes as the author had put before them could not be adopted with the present state of feeling among the people. They would not have men who did all the brainwork for them, and left nothing to their intelligence, but expected them to move simply as they were told. Imagine a works where the workmen were responsible to eight different men! It was not possible. They already had shop committees consisting of a combination of trade union representatives and of the management, and if they could get the proper atmosphere (which, to his mind, would not be got with slide rules or stop watches), he believed they could get the output they needed without stultifying the brains, and making beasts of the men who were working for them.

Mr. A. R. STELLING was glad that the Council was encouraging discussion on the question of improved industrial administration, but thought the paper ought not to be called "Scientific Management," but rather "Idealised Taylorism. Since Dr. Taylor's views were brought to this country and studied by employers they had developed a British scientific management which aimed at getting the maximum output from the factory, which was a totally different thing from getting the maximum output from the individual. All through the paper emphasis was laid on the output of the individual. He regretted that there was no mention of the excellent work done by Prof. Kent, by Dr. Vernon Hill, Dr. Collis, and other engineers. British scientific management recognised that Taylor's four great principles were as true to-day as they were 30 years ago. Those principles were: (1) The study of the job. (2) The selection, training, and development of the worker. (3) The hearty co-operation of

the worker. (4) The adequate division of the responsibility. They started with the study of the human factors, the conditions which surrounded the worker and the management, and generally the condition of the factory. His definition of scientific management was the elimination of all forms of waste, the waste that followed from people rushing about doing things which it was not their business to do, instead of the whole thing being properly thought out and methodically arranged; waste of energy and vitality, men doing work for which they were not fitted or which was too hard for them; waste of skill; waste of time in moving work about the shop. British scientific management would overcome all that by methods which were intensely human and directed by common sense. They wanted a square deal between the men on the one side and the employer on the other, perfect frankness and perfect agreement over what was going to be done. Those were the lines of British scientific management. If capital and labour would come together scientific management would formulate a programme and put it on the table. From that point of view he thought it ought to be studied.

Mr. ALLCOCK said that there was a feeling that, underlying the whole basis of Taylorism was a kind of German regimentation to which they all felt very much opposed. It seemed preferable to work along the lines advocated by the Higher Production Council. The underlying principle was that the whole of the workshops of a particular description would work together. They ought to encourage the team spirit rather than the driving of the individual. He shared the views advanced by Mr. Mensforth about the danger of dehumanising industry. The Higher Production Council quoted as one of the examples in support of its proposal the scheme introduced, he thought, by Priestman Bros., of Hull. They assessed in agreement with their workers the standard output of their particular works. Assuming the standard output was 100 tons per week or per month, if that was increased by 20 per cent., the wage of everyone in the establishment, from the managing director to the office boy, was in the next month increased by the same percentage. That had all the elements of simplicity. There was no room for suspicion on the part of the worker, and he had very tangible results very soon after he had earned them. That was a very important point, because the average working man did not appreciate any scheme for his better pay unless he got it on the Friday night, and every Friday night. He did not appreciate a proposal of profit sharing which might result in his receiving 5 or 7 or 10 per cent. dividend at the end of the year. The only way to increase their output—and output must be increased if they were to maintain the present high wages—was some method of payment by results, and that payment should immediately follow the effort.

Mr. PILLING was in general agreement with the criticisms already expressed on the paper. He very much questioned whether any good was done to an industry by driving men to the utmost possible effort in an almost inhuman kind of way, with the necessary result that very high wages had to be paid. In these days most people were agreed that capital and labour were equal partners after a certain point had been reached. He was not prepared to agree that profit sharing was really unsatisfactory. Workmen, while quite willing to participate in profits when profits were being made, were not prepared to participate in a reduction of the profit when it was a falling profit, and still less when no profit was being made. The question, therefore, arose: Was it possible to have a profit-sharing scheme so arranged as to remove that most serious obstacle? He suggested that in each industry a certain standard profit should be agreed upon—a reasonable profit to the capitalist. When the amount of that profit was exceeded the surplus should be divided into two parts, one of which was to pass to the capitalist at whose works they were made, the other part to the workers who had made them. The distinctive feature of his suggestion was that the profit should not pass to the workers in the place where it was earned, but into a common pool, and the common pool should be held in trust by some administrative board for the benefit of the workers to be distributed in some way to be mutually agreed upon. He would earmark the first distribution for the relief of unemployment. The evil of the present situation was that the workman thought that excess profits were being made by the capitalist, and that he was not getting his proper share of them. Under the system that he had suggested the workpeople in all establishments would benefit to an equal degree in the prosperity of the industry. It would never do to let the surplus earnings go to the workpeople at the establishments where they were earned; they must necessarily be distributed as a common pool, otherwise discontent would be rampant all round.

Mr. SANDS was quite in accord with the views expressed by previous speakers regarding the human side of the business; the psychology of the worker was almost entirely left out. In connection with time studies the author referred to the question of the first-class man. In general the first-class man was superseded right away on repetition work by a girl who had been on the job for two or three months. The portion of the paper relating to scientific individualism *versus* Socialism, to his mind, was grossly unscientific; it developed an irrelevant and unnecessary controversy. The true view of scientific management was that it was the replacement of tradition and rule of thumb by considered methods based upon a study of the problem. He held the average British workman in high esteem, and he did not think it was altogether in keeping with their prestige as scientists that they should start him on scientific management with a scathing condemnation of the present labour leaders. In due course, if they could pursue the right path, as they could do with scientific management, he would be man enough to see it and admit it in the long run.

Mr. A. P. M. FLEMING said that under the Taylor system the selection of men was very rigid and exacting. What happened to the rejects? To those who might not have had occasion to study the literature on the subject he would utter a word of warning against the flood of literature that was being poured out in book form nowadays on the subject, not necessarily under the heading "scientific management" but also under other headings, such as industrial administration and kindred subjects; much of that came from the States, and a large proportion of it was absolute piffle.

Mr. J. G. PEARCE thought that the chief reason why scientific management had relatively failed in the United States was not because the principles were not valid, but that they had been applied dogmatically to all sorts of plant irrespective of local conditions. Some aspects had been grossly overdone; others had been neglected. British employers did not mistake an organisation chart for organisation or a diploma in industrial administration for a qualification for management. Scientific management must be judged entirely by its results. Scientific management was not a code of rules which could be mechanically applied, and Taylor and others by making extravagant claims had done a great deal to hinder the inevitable development of this science of organisation and the recognition of the technique of management as distinct from the practical side. To his mind, Emerson's system was much more elastic than that of Dr. Taylor, and much more congenial to British people. No change in management could be made without the knowledge and willing consent of the workers, and that must be based first of all on confidence. Education, particularly in economics, would do much to establish that confidence. Through industrial research they got that systematic progress in materials, processes, and designs which had been too frequently excluded in the discussion of scientific management in the few fully documented instances that they had of scientific management being applied to factories. They did not know even now to what extent the improvement was due to improved organisation, and to what extent it was due to the employment of better materials and better processes such, for instance, as high-speed steel.

Mr. J. D. PATON thought that Dr. Taylor should have the credit of being the originator of the movement, and that he had handled the subject in a plain honest way. He challenged any manager who had tried to introduce an innovation in his shop to say that he ever got it going on a voluntary basis. Dr. Taylor had handled the problem with judgment and they wanted to handle it in the same way. He had not forgotten the human element.

Mr. G. A. JUHLIN believed that one of the big factors, and one which had not been emphasised sufficiently, was the question of education. It was, to his mind, utterly futile to set up a Board of Scientific Management and to try to impose on an uneducated man certain so-called scientific facts. When labour said quite plainly: "We are not prepared to produce for the profit alone of a certain class," he did not think that scientific management was likely to achieve the desired result.

Capt. SCOTT MAXWELL, in reply, said that the humanising of industry was the one thing he meant to consider, yet he was now told it was the very thing that scientific management could not possibly do. Dr. Taylor said that the attitude of the workpeople was of primary importance. Dr. Taylor recognised that the muscular type of man should have sufficient intelligence to know how to do his work, and he cultivated that intelligence so that the man with less effort could do nearly four times as much work, and he got very much more pay. Could it be said that that was eliminating the intelligence of that man? Anyone who had lived in America must know that scientific management and bad labour conditions had nothing to do with each other. It was because the conditions were so shockingly bad in America, because the employer there was two generations behind the British employer in his attitude towards labour, that it was almost impossible to adopt scientific management. It must not be adopted by any employer who had still the idea in his head that his chief function was to exploit the worker. Mr. Mensforth spoke about taking orders from eight people; but really the workman had to take orders from only one of those persons. Where they had proper planning and everything else, disciplinary orders were not needed to anything like the same extent. The foremen were more like instructors in the works. Taylor doubted the trade unionism in America as he knew it, but he was not opposed to trade unionism, and he wanted to improve the lot of the worker. The employers had given far more opposition to the movement than the men themselves. Mr. Stelling advocated team work and getting the maximum output from the factory rather than from the individual; well, a team was an aggregation of individuals, and if every individual in the factory did his best it seemed to him that they got the maximum output. Scientific management made a square deal possible because it enabled them

to measure the work done, and when they had measured it a square deal could be made between capital and labour, but they could not while each was trying to bluff the other. Socialists believed scientific management was a good thing, but they would not have it under the capitalist system because if it were adopted there would not be much chance for socialism for many generations to come. His ultimate object was to eliminate waste so that the workers might produce the same amount (or more) with about half the effort. A 30-hours' week was a possibility. He believed that work and the creation of wealth should be so easy that the ownership of wealth would cease to give prestige. Under the present conditions it was impossible for the workers to make enough money or have enough leisure to improve themselves. He wanted the work to be very much shorter and the money to be very much higher. With scientific management driving was absolutely unnecessary. If one went into a factory organised on the Taylor system one would think the men were all very slow. If they eliminated one half the work as useless, they could go fairly leisurely about the remaining half. The only drive was the desire of the men to make more money. They wanted far more education. There was no question about that—not for workers only, but for everyone—but he could not see that that affected the worker. Management in the past had been very inhuman, and scientific management was the first form of management that had really paid very great attention to the worker. Taylor thought the demand for scientific management would come from labour.

FAILURES OF TURBO-GENERATORS, AND SUGGESTIONS FOR IMPROVEMENTS.

By J. SHEPHERD, M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page* 93.)

The water path is along the shaft from beyond the exciter with helical flow under the cooling support for the end loops, along the hollow teeth to the other end of the rotor, helically under the second support for the end loops. The water discharge could be arranged either at the flanged coupling as in fig. 9, or could be continued through the turbine rotor shaft to the water sealing gland at the low-pressure end of the turbine.

Fig. 6 is a section of the stator with two types of coil supports, one for the end windings and fixed at the ends of the core, and the other built into the core between batches of laminations. The latter support is constructed with the

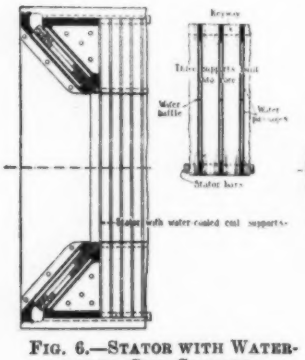


FIG. 6.—STATOR WITH WATER-COOLED COIL SUPPORTS.

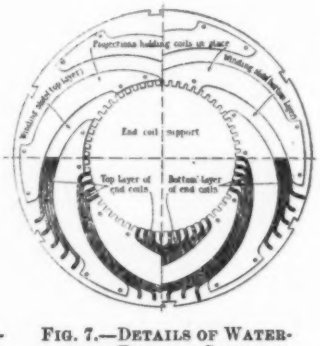


FIG. 7.—DETAILS OF WATER-COOLED END-COIL SUPPORTS.

inner part laminated to reduce eddy currents, and yet of considerable strength to clamp the portions of the stator bars it embraces and gives considerable stiffness to the core teeth. The hollow interior is divided by a diaphragm into flow and return water passages.

The two pairs of end coil supports at the ends of the stator are shown in section with the two layers of end connections clamped between them.

Fig. 7 shows an end elevation of the stator end (inner) coil support, the bottom quadrants of which illustrate respectively the under and upper layers of the end windings. The two upper quadrants show the supports without windings, and with the clamping projections in place, forming between pairs of them the winding recesses for a group of end connections, one bar per slot winding.

Fig. 8 is a part section of such a winding recess, with four end connections in place, supported by the projection on each side. It shows the coils clamped directly over a water-cooling duct cast in the support and enclosed by a metal plate fusion-welded in place. The plate must have considerable mechanical strength and high electrical resistance. Copper-nickel alloys are on the market, which are as strong as high-quality bronze, and have over 20 times the electrical resistance of copper. Their use would reduce the stray currents to a comparatively insignificant loss.

When arranging the water circulating system, due regard must be paid to the risk of corrosion and to the recommendations of the Corrosion Committee of the Institute of Metals, viz. :—

(1) Only clear water to be used.
(2) Water to be free from gases in suspension or solution.
(3) Water must be neutral, or only very slightly alkaline.

To comply conveniently with these recommendations, the cooling water is taken from the condensate of the steam turbine, forced by the extraction pump through the cooling devices of the alternator and discharged into the turbine hot-

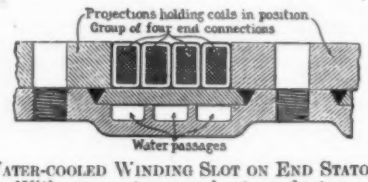


FIG. 8.—WATER-COOLED WINDING SLOT ON END STATOR SUPPORT, With copper tapes as heat conductors.

well. The whole of the heat losses in the alternator would then be utilised. With modern high vacua the temperature of the condensate is from 70 deg. to 80 deg. F., which temperature would then receive an increment of from 13 to 15 deg. F.

The return flow of each water path is shown provided with a thermometer pocket, and by reducing the flow in any particular cooler a close indication of the maximum local temperature can be obtained.

The object aimed at in all the designs described is to interleave the conductors with liquid-cooled supports, thus providing continuous winding slots for the coils, coil loops and end connections, &c., in which the weakest and most frail bar (no matter how thoroughly the bar be laminated) is continuously supported under the most severe short-circuit conditions. At the same time, freedom for expansion is provided, together with low-resistance heat paths to the cooling medium.

As every portion of stator and rotor windings would be enclosed in cool metal winding slots, the cooling would be much improved and the fire risk practically eliminated. The absence of ventilating ducts in the stator would be the immediate gain of solid cores and firm support over the entire surface of the stator teeth.

The problem in the plainest terms is the possibility of constructing stator cooling devices capable of withstanding a water temperature of about 120 deg. F. and a pressure of 50 lb. or less per sq. in., whilst at the same time the devices must have sufficient strength to withstand the short-circuit stresses on the stator. The rotor cooling devices are subjected only to the internal water pressure and stresses resulting from centrifugal forces. Adequate mechanical strength can be given to these devices by the use of suitable material, proportioned in accordance with well-known methods.

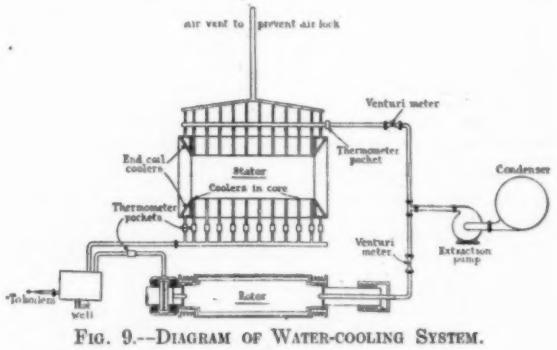


FIG. 9.—DIAGRAM OF WATER-COOLING SYSTEM.

With respect to the prevention of water leakage, all joints can be constructed of a character similar to those used in hydraulic practice, and dealing with pressures of over 2 tons per sq. in., or in accordance with steam practice, with high-pressure superheated steam at 300 lb. pressure per sq. in. and a temperature of 700 deg. F. Fusion welding is now an accepted construction for the more arduous requirements of high-pressure boilers and steam piping. Moreover, the fusion-welded water joints may be designed so that the weld is subjected to no other stresses than those caused by the internal water pressure. Consequently, combining skilful design, stout construction, and reliable workmanship, one can ensure no movement of the coils, no leakage of the water devices, and no overheating of the coils. Under such conditions, failure of machines should be infrequent. Should, however, a short-circuit in a machine occur, the walls of the cooling ducts might become fused, in which extreme case a jet of water

would immediately flood the machine; but even so, this flooding by water would only occur after a burn-out had happened, and in such circumstances a stream of water playing upon the fire would certainly be better than a fierce blast of air. In all cases, prevention is better than the best remedy, and the improvements suggested are all of a preventive character.

It will be seen, therefore, that whilst water cooling will remove many if not all of the risks inherent in the ordinary air-cooled machine, there is nothing in its application that presents any real difficulty or introduces any method of construction which has not been established in other branches of engineering.

The cooling effect of water is so considerable that without certain precautions, condensation difficulties may arise. If the temperature of the cooling devices falls below the dew point atmospheric condensation upon them will take place. This can be avoided by using cooling water with an inlet temperature higher than the dew point, as by the method shown in fig. 9.

As the output of most machines is rated by ultimate temperature, there are substantial grounds for concluding that water cooling will allow an increase in output for the same total weight and volume of 25 to 33 per cent. Some readjustment of relative copper and iron losses may be necessary, and the result should be a substantial reduction of average temperatures and weight for the same output.

There are, however, a number of cases where water cooling offers advantages over air cooling, quite apart from the improved and more robust construction of machines, *i.e.*, for machines working under the following conditions:—

(1) In hot climates where cool air is difficult to obtain.

(2) In extremely dirty and sulphurous atmospheric conditions.

(3) At high altitudes with reduced air density.

(4) On board ship, where air cannot be freed from salt spray.

As an example of turbo-generators working at high altitudes, the stations on the Rand may be cited. At an elevation of 6,000 ft. and a barometer of 24.5 in. the air density would be 82 per cent. of normal, and a standard turbo-generator frame of 10,000 K.V.A. would only be suitable for an output of approximately 8,500 K.V.A. air cooled. The same frame if adapted for water cooling would probably give an output of 12,500 K.V.A.

Consequent upon the higher ambient temperature of the South African climate, water cooling would have the further advantage of a much lower average temperature of windings.

SHIP PROPULSION.

The field for the electrical propulsion of ships is practically virgin and immense in size. The one great difficulty is the presence of salt water. It is difficult to see how the cooling air can be collected in large volumes free from salt spray.

The air ducts are of considerable dimensions, and it is doubtful if any shipowner would sacrifice valuable carrying space to accommodate them. In fighting ships the problem is more difficult, as the powers to be developed are higher and the space is enormously costly. The objections might be so serious as to outweigh any advantages of electric propulsion.

With water cooling, the difficulties of collecting and conveying the cooling medium disappear, and its use presents neither the difficulties of large ducts nor the trouble of filtration.

Proposals have been made to re-circulate the air through a closed pipe system with air coolers; the sizes of air ducts are so considerable that room for them could not be found with the present allowance of engine-room space. There is now usually considerable difficulty in finding room for the comparatively small steam pipes and valves.

Watertight windings would be a great advantage. A substantial seal of vulcanised rubber could be "cured" in place over the insulated joints, using the cooling devices as heaters, by passing low-pressure steam through those which embrace the ends of the stator bars. This waterproof treatment of the stator joints would be of advantage if surface condensation took place. The ideal alternator for marine purposes should be capable of being cleaned down with a hose pipe.

If electrical propulsion is to progress, the problem must be attacked in a thoroughly practical way, as electrical methods will be in opposition to establish interests and in competition with thoroughly sound and well-tried steam plant evolved after years of practical sea experience.

CONCLUSION.

Whether we like the idea of liquid cooling or not, the question has to be faced in the immediate future, and the full consideration of its uses gives an opportunity of considering alternator design from a new point of view.

Having regard to the necessarily few moving and wearing parts of a turbo-generator, viz., journals, bearings, and slip-rings, there appears to be no sound reason why it should not have as long a physical life as the low-speed plant it has superseded, provided it be possible to construct machines which do not overheat, the coils of which are efficiently and continuously supported against all stresses and vibration, and that the fire risk be removed.

If the arguments put forward in the paper are sound, machines can be constructed embracing those features, and with machines so constructed a much longer physical life may be anticipated. With dear money and expensive plant, longer physical life will be an economical necessity of the immediate future.

THE ELECTRICITY SUPPLY ACT 1919.

THE following is a summary of the provisions of the Electricity (Supply) Act, 1919, which was published last week. The Act can be obtained from H.M. Stationery Office, price 4d. net:—

1. For promoting, regulating, and supervising the supply of electricity there shall be established a body to be called the Electricity Commissioners, not exceeding five in number, who shall act under the general directions of the Board of Trade. Three of the Commissioners shall be whole-time officers; three of the Commissioners shall be selected for practical, commercial, and scientific knowledge and wide business experience, including that of electrical supply. The Commissioners may act by two of their number.

2. The Board of Trade may exercise through the Electricity Commissioners any of their powers and duties relating to the supply of electricity.

3. The Commissioners may conduct experiments for the improvement of the methods of electric supply or of the utilisation of fuel or water-power, and incur such expenditure as may be necessary.

4. The Commissioners may appoint an advisory committee.

5. The Commissioners may provisionally determine that any district in the United Kingdom shall be constituted a separate electricity district for the purposes of this Act, and, if any objection be made, shall hold a local inquiry. Where it appears that the existing organisation for the supply of electricity in a district should be improved, the Commissioners shall hold a local inquiry, and shall give authorised undertakers, county councils, local authorities, railway companies, large consumers of electricity, and other bodies within the district an opportunity to submit a scheme for effecting such improvement, including proposals for altering the boundaries of the district, and, where necessary, the formation of a joint electricity authority for the district. If no such scheme is submitted within the time allowed, or if no scheme submitted is approved by them, the Commissioners may themselves formulate a scheme, publish it, and shall hold a local inquiry thereon.

6. A scheme under the last-foregoing section may provide for the establishment and incorporation of a joint electricity authority representative of authorised undertakers, county councils, local authorities, large consumers of electricity, and other interests within the electricity district, and for the exercise by that authority of the powers of the authorised undertakers within the district, and for the transfer to the authority of the whole or any part of the undertakings, upon such terms as may be provided by the scheme. No such scheme shall provide for the transfer to the authority of any part of an undertaking except with the consent of the owners thereof. The scheme may provide for payment of expenses of members of the authority, and reasonable compensation for loss of remunerative time.

7. The Commissioners may make an order giving effect to the schemes, which shall not come into operation until it has been approved with or without modification by a resolution passed by each House of Parliament.

8. It shall be the duty of every joint electricity authority constituted under this Act to provide or secure the provision of a cheap and abundant supply of electricity within their district, and for that purpose every such authority shall have such powers and duties as are conferred upon them by the scheme under which they are constituted or by this Act with respect to:—

(*a*) the supply of electricity within their district (including the construction of generating stations, main transmission lines, and other works);

(*b*) the acquisition of the undertakings or parts of the undertakings of authorised undertakers;

and powers incidental thereto. Every such authority shall comply with any general directions given to them by the Commissioners as to the exercise and performance of their powers and duties. A joint electricity authority may, with the approval of the Commissioners, establish a scheme for the payment of superannuation allowances and gratuities to any of their officers and servants who become incapable of discharging their duties.

9. A joint electricity authority may, with the consent of the Commissioners, by agreement with the owners thereof acquire any generating station or any main transmission line on such terms as may be agreed.

10. Where a joint electricity authority or any authorised undertakers are authorised to acquire or use any land for the purpose of a generating station, no person shall be entitled to restrain the use of the land for that purpose.

11. It shall not be lawful for any authority, company, or person to establish a new or extend an existing generating station or main transmission line without the consent of the Commissioners (which consent shall not be refused or made subject to compliance with conditions to which the authority, company, or person object, unless a local inquiry has been held); but this restriction shall not apply to the establishment or extension of a private generating station, provided that, in the case of a new station, the owner thereof shall comply with regulations made by the Commissioners as to the type of current, frequency, and pressure to be used; but such regulations shall be so framed as not to interfere with the economical and efficient working of the business for

which the supply is generated. In the case of a railway company or a dock undertaking regulated by Act of Parliament, consent shall not be refused unless it is proved that a joint electricity authority or authorised undertakers can give an adequate supply of electricity at a cost not greater than would have been incurred by the railway company or dock owners in supplying themselves. Where a group of persons carrying on businesses in which large quantities of electricity are used for purposes other than power or light propose to establish a generating station for the purposes of such businesses; or where a manufacturer, having a business in which electricity can be generated from energy derived from a process of manufacture carried on in his premises, proposes to establish a generating station for the purpose of supplying electricity not only for his own business, but also to other manufacturers whose businesses are associated therewith, the Commissioners may authorise the establishment, by those consumers or that manufacturer, of a generating station, subject to the condition that any surplus electricity shall be supplied to the joint electricity authority, or any authorised undertakers, at such prices as the Electricity Commissioners may think fit and proper.

12. A joint electricity authority shall not supply electricity in any area which forms part of the area of supply of any authorised distributors without the consent of those distributors, except for railway or canal traction or haulage, or for lighting vehicles and vessels for the haulage of which electricity is supplied, or for the purpose of charging electric vehicles not running on rails; or in any part of the area of supply of a power company for any purpose for which the company are therein authorised to supply electricity, without the consent of the company, except to the previous owner of a generating station which has been transferred to the joint electricity authority or for the purpose of charging electric vehicles not running on rails. Where the authorised distributors or power company withhold their consent, the joint electricity authority may appeal to the Commissioners and the Board of Trade on the recommendation of the Commissioners may dispense with such consent if in their opinion it is unreasonably withheld. Sections 2 and 3 of the Electric Lighting Act, 1888 (which relate to the purchase of undertakings by local authorities) shall not apply to the undertakings of joint electricity authorities. The Commissioners may by order, after such inquiry as they think fit, impose on any joint electricity authority an obligation to supply electricity in such circumstances, within such areas, and on such terms and conditions as to price and otherwise as may be specified in the order.

13. Any local authority may, with the consent of the Commissioners, agree with the joint electricity authority of the district for the transfer to the joint authority of the whole or any part of its undertaking. Where any right to purchase the whole or any part of the undertaking of any authorised distributors is vested in any local authority (including a county council), the right may be transferred to and vested in the joint electricity authority, subject to the representation on the joint authority of the local authority from whom the right is transferred. A joint electricity authority with the consent of the Commissioners may at any time acquire the whole or any part of the undertaking of any authorised undertakers not being a local authority, by agreement.

14. The Commissioners may, on the application of a joint electricity authority, by order exclude from the area of supply of any power company any part of that area which is not supplied by the company, and which could be better served by the joint authority. If those interested object to the proposed order, effect shall not be given to the proposals except by special order.

15. The Board of Trade, on the representation of the Commissioners, may by order authorise any joint electricity authority or any authorised undertakers to abstract water from any river or other source, and to utilise and return the water so abstracted, subject to such conditions as may be specified in the order. Where any existing rights will be affected by the abstraction of the water, the order shall be a special order. A joint electricity authority and any local authority, company, or person may, with the consent of the Commissioners, enter into arrangements for the utilisation of water power, waste heat, or other form of energy. The purposes for which a joint electricity authority may be authorised to acquire compulsorily or use land under Section 1 of the Electric Lighting Act, 1909, shall include the development of water-power for the generation of electricity. A joint electricity authority may, with the consent of the Commissioners, erect and renew by-product plant for working up and converting the residual products arising from the generation of electricity.

16. If within five years from the date when under this Act a transfer of any part of an undertaking has been effected, or a scheme has come into operation, any officer or servant who has, before May 8th, 1919, been regularly employed in or about any authorised undertaking proves to the satisfaction of referees appointed by the Minister of Labour that in consequence of this Act he:—

(i) has suffered loss of employment, or diminution of salary, wages or emoluments, otherwise than on grounds of misconduct, incapacity, or superannuation; or

(ii) has relinquished his employment in consequence of being required to perform duties such as were not analogous or were an unreasonable addition to those which before the said eighth day of May he had been required to perform; or

(iii) has been placed in any worse position in respect to the conditions of his service (including tenure of office, remuneration, gratuities, pension, superannuation, sick or other fund, or any benefits or allowances, whether obtaining legally or by customary practice),

and the body to which the undertaking was transferred, or the authorised undertakers who are affected by the scheme, do not show that equivalent employment on the like conditions was available, there shall be paid to him by that body or those undertakers such compensation as the referees may award, including any expenses which the officer or servant necessarily incurs in removing to another locality. Such compensation shall, in the case of an officer employed on an annual salary, be based on but not exceed the amount which would have been payable to a person on abolition of office under the Acts and rules relating to His Majesty's Civil Service in force at the date of the passing of the Local Government Act, 1888, but in computing the period of service of any officer, service under any authorised undertakers shall be reckoned as service under the authorised undertaker in whose employment he is at the time that he suffers such loss or diminution as is mentioned in this section; and, where any such officer or servant was temporarily absent from his employment whilst serving in or with His Majesty's Forces or the forces of the Allied or Associated Powers, or in any other employment of national importance during the war, such service shall be reckoned as service under the authorised undertakers in whose employment he was immediately before and after such temporary absence.

17. A joint electricity authority before incurring any capital expenditure shall submit details, plans, and estimates.

18. It shall be lawful for the Board of Trade, after consultation with the Commissioners, at any time after an electricity district has been provisionally determined and before the establishment of a joint electricity authority for the district, and for two years after its establishment, to construct any generating station, main transmission line, or other works, and exercise any other powers which a joint electricity authority can exercise under this Act. The Treasury may issue to the Board of Trade any sums, not exceeding in the aggregate twenty million pounds, required for the construction of any such works or the acquisition of land, or required for working capital. At the expiration of two years after the establishment of a joint electricity authority for any district, or at any earlier time which may be agreed on, any generating station, main transmission lines and other works, and any land acquired for the purpose thereof by the Board of Trade within the electricity district, shall vest in that authority, subject to the repayment of the advances made by the Treasury, and any interest thereon which may be outstanding. The prices fixed by the Board of Trade for electricity supplied by them from generating stations established under this section, shall be such that their receipts therefrom will be sufficient to cover their expenditure on income account (including interest and sinking fund charges in respect of such advances as aforesaid) with such margin as the Board may think fit.

19. During the period between the passing of this Act and the establishment of a joint electricity authority for a district, any two or more of the authorised undertakers within the locality may, with the approval of the Commissioners, and if so required by the Commissioners shall, carry into effect arrangements for mutual assistance of the one by the other, with regard to the supply and distribution of electricity, the management and working of the undertakings, the provision of capital required, and the division of receipts arising under any such arrangement, on such terms as may be agreed, or as in default of agreement may be settled by the Commissioners. The provision of capital required for giving effect to any such arrangement by loan is authorised.

20. The powers of the Minister of Health and the Secretary for Scotland and the London County Council with respect to the sanctioning of borrowing by local authorities shall be transferred to the Commissioners.

21. Where the consent of the Board of Trade is obtained to the placing of any electric line above ground in any case, the consent of the local authority shall not be required, but the Board of Trade before giving their consent shall give the local authority an opportunity of being heard.

22. A joint electricity authority or any authorised undertakers may place any electric line below ground across any land, and above ground across any land other than land covered by buildings or used as a garden or pleasure ground in cases where the placing of such lines above ground is otherwise lawful, and may enter on the land for the purpose of repairing or altering the line: Provided that, before placing any such line across any land, the joint electricity authority or undertakers shall serve on the owner and occupier of the land notice of their intention, together with a description of the nature and position of the lines proposed to be so placed; and if, within 21 days after the service of the notice, the owner and occupier fail to give their consent or attach to their consent any conditions to which the joint electricity authority or the undertakers object, it shall not be lawful to place the line across that land without the consent of the Board of Trade; and the Board of Trade may, if after giving all parties concerned an opportunity of being heard, they think it just, give their consent subject to such

terms, conditions, and stipulations as they think just. The Board shall have regard to the effect, if any, on the amenities or value of the land of the placing of the line in the manner proposed. The power of placing lines across land shall include the power of placing a line across or along any railway, canal, inland navigation, dock or harbour, subject to the rights of the owners thereof.

23. A joint electricity authority and any local authority authorised to supply electricity may provide, let for hire, and in respect thereof may connect, repair, maintain and remove (but shall not, unless expressly authorised to do so, manufacture or sell) electric lines, fittings, and appliances for all purposes for which electricity can or may be used. Any electric lines, fittings, and appliances provided by any authorised distributors on consumers' premises, and any lands, buildings, or works held by them in connection therewith shall be deemed to form part of their undertaking.

24. The Commissioners may require any authorised undertakers to alter the type of current, frequency, or pressure employed by them in their undertaking, and the execution of the works necessary to comply with such an order shall be a purpose for which a local authority may borrow under the Electric Lighting Acts. This section shall not apply to electricity generated at a railway generating station existing at the passing of this Act. If, on appeal by any authorised undertakers, the Board of Trade are satisfied that compliance with the order would entail unreasonable expense, they may direct that the order shall not apply to those undertakers.

25. Section 26 of the Electric Lighting Act, 1882 (which contains provisions for the protection of the Postmaster-General), shall have effect as if the words "or the laying of connections with mains where the direction of the electric lines so laid down crosses the line of the Postmaster-General at right angles at the point of shortest distance, and continues the same for a distance of 6 ft. on each side of such point" were omitted, and as if for the words "not more than 28 or less than seven clear days" there were substituted the words "one month, or, in the case of the laying of service lines to consumers' premises, seven clear days."

26. Anything which under the Electric Lighting Acts may be effected by a provisional order confirmed by Parliament may be effected by a special order made by the Electricity Commissioners and confirmed by the Board of Trade, or by an order establishing a joint electricity authority under this Act. A special order made in pursuance of the powers conferred by this section shall be laid before each House of Parliament, and shall not come into force unless approved by a resolution passed by each such House.

27. Joint electricity authorities and authorised undertakers shall furnish to the Commissioners such accounts, statistics, and returns as they may require.

28. Every joint electricity authority shall annually submit to the Commissioners a statement of income and expenditure on revenue account. The accounts shall be audited by auditors appointed by the Commissioners.

29. The Commissioners shall, at the beginning of each financial year, prepare an estimate of their receipts and expenditure during the year, and submit it for approval by the Board of Trade. The Commissioners shall apportion the amount by which the estimated expenses exceed the estimated receipts amongst the several joint electricity authorities and authorised undertakers within the United Kingdom in proportion to the number of units of electricity generated respectively in the preceding year; and every such authority or undertaker, shall pay as a contribution towards their expenses the sum so apportioned. During the first two years after the passing of this Act, the amount of such excess shall be paid out of moneys provided by Parliament, but such payments shall be treated as advances and shall be repaid with interest by the Commissioners by equal annual instalments in the next three succeeding years.

30. Joint electricity authorities or any authorised undertakers may pay reasonable subscriptions to the funds of any association formed for the purpose of consultation as to their common interests and the discussion of matters relating to the supply of electricity, and to the funds of any recognised association conducted on a non-profit-earning basis for developing the use of electricity, and may purchase reports of the proceedings, and may pay the reasonable expenses of attendance of any members or officers at conferences or meetings.

31. Section 4 of the Conspiracy and Protection of Property Act, 1875 (which relates to breaches of contract by persons employed in the supply of gas or water), shall extend to persons employed by a joint electricity authority or by any authorised undertakers in like manner as it applies to persons mentioned in that section, with the substitution of references to electricity for the references to gas or water.

32. Where under this Act a joint electricity authority are authorised to enter into an agreement with any body or person for any purpose, it shall be lawful for such body or person to enter into and carry into effect such agreement.

33. The Commissioners may cause to be held such inquiries as they consider necessary for the purposes of this Act, and may by order require any person, subject to the payment of the reasonable expenses of his attendance, to attend as a witness and give evidence.

34. The Board of Trade and the Electricity Commissioners may respectively make rules in relation to applications and other proceedings before them under this Act, and to the payments to be made in respect thereof, and to the publication of notices and advertisements.

35. A special order made under this Act by the Electricity Commissioners shall not have any effect unless and until confirmed by the Board of Trade. Before any special order, other than a special order which is not valid unless approved by a resolution passed by each House of Parliament, comes into force it shall be laid before each House of Parliament for a period not less than 30 days.

37. This Act shall apply to Scotland, and the Commissioners shall appoint a committee for Scotland.

38. This Act shall apply to Ireland.

39. All the powers and duties of the Board of Trade relating to the supply of electricity shall, as from such date as His Majesty in Council may fix, be transferred to the Minister of Transport, and accordingly references to the Board of Trade shall be construed as references to the Minister of Transport. The power of appointing Electricity Commissioners under this Act shall be exercised by the Minister of Transport with the concurrence of the Board of Trade. The Commissioners shall be solely responsible to the Minister of Transport, and the Minister shall refer to the Commissioners for their advice on all matters connected with the exercise of the powers and duties transferred to him, except the appointment of the Commissioners.

SCHEDULE.

Before the Board of Trade confirm any special order under this Act, they shall publish notice of the proposal to confirm the order, and of the place where copies of the order may be obtained, and of the time (not less than 21 days) within which any objection made with respect to the order must be sent to the Board of Trade.

Where the Board of Trade do not amend or withdraw any order to which any objection has been made, then they shall, before confirming the order, direct an inquiry to be held, and may, after considering the report of the person who held the inquiry, confirm the order either without modification or subject to such modification as they think fit, or may refuse to confirm the order.

NITROGEN FIXATION.

THE Final Report of the Nitrogen Products Committee was published last week. The report (Cmd. 482), which can be obtained from H.M. Stationery Office (4s. net), is a volume of 357 pages, containing a vast amount of valuable information, and is well indexed.

We are devoting more space to this subject in a later issue, but the chief points in the report touching the electrical industry are briefly as follows.

Some of the factors which aided the committee to arrive at its recommendations are:—

(i) The sources of supply of combined nitrogen in the United Kingdom must be increased considerably if the existing and prospective home demands are to be met and the pre-war scale of exportation is to be maintained.

(ii) The existing sources of supply of combined nitrogen in the United Kingdom proved wholly inadequate for meeting the war demands.

(iii) The world's demand for combined nitrogen appears to double every ten years. The increased production during the war has not been more than the normal rate of increase during peace.

(iv) The actual consumption of combined nitrogen for agriculture in the United Kingdom has practically doubled during the war, and there is certain to be a further increase.

PROVISION FOR NATIONAL SAFETY.

The following measures are recommended by the Committee as a *minimum* provision for safeguarding the future and for meeting a portion of the growing home demand for various nitrogen products.

Calcium Cyanamide Process.—The Committee recommends that:—

(i) This process should be established in Great Britain without delay, either by private enterprise (supported, if necessary, by the Government) or as a public work.

(ii) The scale of manufacture should be sufficient to give an output of about 60,000 tons of cyanamide per annum, equivalent on the basis of combined nitrogen to about one-eighth of the present home production of ammonium sulphate.

(iii) The necessary electrical energy should be obtained either from water power in Scotland or from a large steam-power station.

The Committee has ascertained from the Water Power Resources Committee of the Board of Trade that there are several sites in Scotland where the necessary water power can be developed at a reasonable cost. If steam power is used, a suitable site for the cyanamide factory might be obtained at one of the capital power stations proposed by the Board of Trade Committee on Electric Power Supply, and the costs given hereunder are based upon that assumption.

On the basis of pre-war prices plus 50 per cent., the approximate capital outlay at a water-power site would be £1,680,000, inclusive of the capital cost of the hydro-electric development, the latter being taken at £40 per E.H.P. (£53.6 per KW.) of maximum demand. If the factory were erected at the site of a large steam-power station, the approximate outlay would be £800,000, inclusive of the proportionate cost of the power plant. The chemical sections for either site would cost about £445,000 of the above totals.

Upon the same basis (*i.e.*, pre-war prices plus 50 per cent.), the approximate cost, at the factory, of raw cyanamide (19.5 per cent. N.) would be :—

Source of power.	Price of electrical energy. Per KW. year.	Factory costs per metric ton of— Raw product. (19·5 per cent. N.)	Combined nitrogen as raw cyanamide.
	£	£	£
Water	4	6·4	32·8
Steam (with coal at 11s. 3d. per ton)...	5·6	7·0	36·0

The factory costs include interest on the capital outlay for the power section of the plant, but not on the chemical section, and are exclusive of any royalties.

As the result of the action taken upon the Committee's interim recommendations, considerable progress was made with the plans and specifications for a suitable steam-power station designed as the nucleus of a possible capital power station.

The committee suggests that it might prove desirable, in the first instance, to arrange for a certain proportion of the calcium carbide produced as an intermediate product to be utilised as such instead of converting it into cyanamide.

Synthetic Ammonia (Haber) Process.—This process has hitherto only been operated on a full commercial scale in Germany. Nevertheless, as a result of the continuous experiments carried out since the summer of 1916 at the Research Laboratory of the Munitions Inventions Department, the Government decided early in 1918 to erect a large factory at Billingham-on-Tees for the manufacture of synthetic ammonia and ammonium nitrate. This factory, projected as an emergency war measure, did not reach an advanced stage.

The committee recommends that the synthetic ammonia process should be established forthwith on a commercial scale and, extended as rapidly as possible, up to a minimum manufacturing scale of 10,000 tons of ammonia (equivalent to 40,000 tons of ammonium sulphate) per annum. The Billingham factory should be utilised for the purpose if practicable.

The evidence on the question of capital cost is somewhat uncertain, but the outlay for a factory of the capacity indicated, on the basis of pre-war prices plus 50 per cent., would probably amount to £600,000 if ammonia were the end-product, or to £780,000 if the factory were laid out for the manufacture of synthetic ammonium sulphate.

By-product Ammonia Industries.

The following recommendations are made, among others, for conserving and increasing the output of combined nitrogen from existing by-product ammonia industries, for securing the better utilisation of the national resources in coal, and for reducing the consumption of *raw* coal as a fuel :—

Encouragement should be given to facilitate and to ensure the replacement of non-recovery coke-ovens by recovery ovens at a much more rapid rate than hitherto, in order that the reserves of coking coal shall be utilised to the maximum advantage.

Encouragement should be given to all efforts to extend the use of coal gas and coke in the place of raw coal for domestic purposes, for steam-raising, and for other industrial requirements.

A special observation is made to the effect that, as far as the United Kingdom is concerned, nitrogen fixation and allied processes will constitute a new "key" industry, and its initiation and development will require the active support of the Government.

NEW PATENTS APPLIED FOR, 1919-1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn. London, W.C. 1.

313-4. "Apparatus for controlling electric currents." C. G. CONRADI. January 5th.
339. "Magnetos." J. F. KEBBELL. January 5th.
342. "Sparking plugs." SOC. INTERNATIONALE POUR L'EXPLOITATION DE LA BOUGIE, SOL. January 5th. (France, July 31st, 1919.)
347. "Inductances for wireless telegraphy and telephony." H. P. REES. January 5th.
358. "Electrical systems." DOMESTIC ENGINEERING CO. January 5th. (United States, April 6th, 1918.)
363. "Electrolytic cells." W. J. MELLERSH-JACKSON (Allen Electrolytic Cell Corporation). January 5th.
372. "Electric heaters." J. HAUSSER-STAUB. January 5th. (Switzerland, August 8th, 1919.)
386. "Anti-vibrators for incandescent electric lamps." E. BOOTH and N. R. BOOTH. January 6th.
404. "Spark plugs." R. R. HILL. January 6th.
426. "Electrically-operated lawn-mower, &c." G. A. BROWNE. January 6th.
431. "Telephone transmitters." V. F. FEENY (Magnavox Co.). January 6th.
444. "Electrically-controller combustion system." T. L. REEFMAKER D'ORVILLE. January 6th.
452. "Electrically-heated cooking device." C. C. ARMSTRONG. January 6th. (United States, June 27th, 1916.)
461. "Shade-holders for electric light fittings." C. J. CALLANDER and F. BUTLER. January 6th.
467. "Electric accumulators." J. H. GREEN. January 6th.
500. "Magnetic clutches." E. T. CAPARN and SCOTTS' SHIPBUILDING AND ENGINEERING CO. January 7th.
502. "Limit switches." E. T. CAPARN. January 7th.
520. "Dial switches for automatic telephone, &c., systems." AUTOMATIC ELECTRIC CO., AUTOMATIC TELEPHONE MANUFACTURING CO., J. LAHN, and S. R. SMITH. January 7th.
534. "Device for locating leakages or short circuits on or between electrical conductors." B. DARBY. January 7th.
549. "Electrodes for electric welding or fusion-deposition of metals." QUASI-ARC CO. and A. P. STROHMENGER. January 7th.
579. "Magneto-electric machines with oscillating armatures." O. IMRAY (Eisemann Magneto Corporation). January 7th.
600. "Ignition devices for internal-combustion engines." F. A. SMITH. January 7th.
602. "Methods of electric power generation and transmission with alternating currents." A. M. TAYLOR. January 8th.
615. "Means for making and breaking electrical circuits." F. M. BROWN and A. E. DAVIES. January 8th.
636. "Sparking-plug tester." A. D. ALYWARD. January 8th.
638. "Filling for storage batteries." S. NARAEAYASHI (C. A. Allison). January 8th.
654. "Zinc battery elements." S. O. COWPER-COLES. January 8th.
655. "Wireless controlling relay." H. E. TAMMELIN. January 8th.
673. "Ventilation of dynamo-electric machines." BRITISH THOMSON-HOUSTON CO. and H. W. TAYLOR. January 8th.
675. "Electric Heating Units." BRITISH THOMSON-HOUSTON CO. (General Electric Co.) January 8th.
695. "Incandescent electric lamps." G. CALVERT. January 8th.
697. "Generation of electricity by rise and fall of tides." R. I. WARD. January 8th.
707. "Electrical switchgear." W. A. COATES, D. R. DAVIES, G. E. GITTINS and METROPOLITAN-VICKERS ELECTRICAL CO. January 8th.
716. "Automatic train stop and track circuit signalling." J. D. N. MOLESWORTH. January 9th.
726. "Electric circuit-breaker." W. H. ILLINGWORTH. January 9th.
729. "Mine-signalling systems." AUTOMATIC TELEPHONE MANUFACTURING CO. and C. REMINGTON. January 9th.
730. "Electric circuit-breaker." R. SIMPSON. January 9th.
736. "Methods for generating and transmitting electric alternating currents." A. M. TAYLOR. January 9th.
752. "Electric cranes, hoists, &c." J. BENTLEY and W. H. SCOTT. January 9th.
761. "Adaptors for electrical connections." J. STRANG. January 9th.
766. "Telephonic transmitters." R. J. B. KNIGHT. January 9th.
775. "Electrically heated garments." A. NEGROMANTI. January 9th.
782. "Electric incandescent lamps." J. J. GOWEN. January 9th.
788. "Means for supporting electric fuses in operative position." L. WEEKES and J. A. WILDING. January 9th.
793. "Electro-magnetic clocks." M. P. FAVRE-BULLE, B. M. M. MOULIN (nés Chenard, legal representative of M. A. Moulin), and M. A. MOULIN. January 9th.
805. "Controller for shunt-wound dynamos." J. HUNT. January 9th.
809. "Wireless telegraph calling devices." W. H. NOTTAGE and T. D. PARKIN. January 9th.
811. "Electric furnaces." H. WADE (Booth Electric Furnace Co.). January 9th.
841. "Combined keyless lock, electric bell switch and electric light switch." F. I. KIRBY. January 10th.
877. "Electric welding." BRITISH INSULATED & HELSBY CABLES, LTD., and L. B. WILSON. January 10th.
878. "Electric plug-connecting appliances." T. W. JEFFERSON and T. W. JEFFERSON, LTD. January 10th.
879. "Electric heating device." ELECTRIC HEATING AND HARDWARE, LTD., and F. J. WINEBERG. January 10th.
886. "Suction cleaning apparatus." J. GRAY (Electric Vacuum Cleaner Co.). January 10th.
887. "Electrical apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co.) January 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

16,865. ELECTRIC MOTOR DRIVES FOR PLANING MACHINES AND THE LIKE. F. T. Haggas and W. Haggas. October 16th, 1918. (136,589.)
20,396. APPARATUS FOR DETERMINING THE DIRECTION OF ARRIVING ELECTRO-MAGNETIC WAVES. J. Erskine-Murray and V. Robinson. December 9th, 1918. (136,600.)
20,543. INDUCTION COILS. M. A. Codd. June 2nd, 1919. (136,601.)
20,686. ELECTRICAL FUSES. Cable Accessories Co., F. H. Reeves and A. Crawford. December 12th, 1918. (136,605.)
21,053. ELECTRIC INSULATORS. J. E. Pollak. (Fabbrica Isolatori Livorno.) December 17th, 1918. (136,627.)
21,283. ELECTRIC SWITCHES. V. E. Joyce and Park Royal Engineering Works. December 19th, 1918. (Cognate application 13,453, 1919.) (136,650.)
21,417. TRANSMISSION AND RECEPTION ARRANGEMENTS FOR ELECTRO-MAGNETIC SIGNALLING. W. E. Barber. December 20th, 1918. (136,654.)

1919.

683. ELECTRICALLY-HEATED MELTING-FURNACES. L. C. Harvey. January 9th, 1919. (136,679.)
1,251. MAGNETOS FOR IGNITION PURPOSES. E. A. Smith. January 17th, 1919. (136,683.)
1,873. ELECTRIC CABLE CARRYING OR SUPPORTING MEANS. A. H. Lessells. January 28th, 1919. (136,691.)
2,448. ANTI-VIBRATION ELECTRIC LIGHT FITTINGS. F. A. Ross. January 31st, 1919. (Addition to 122,707.) (136,694.)
2,484. IGNITION-MAGNETO GENERATING DEVICES. E. C. R. Marks. (Splitdorf Electrical Co.) January 31st, 1919. (136,696.)
3,181. MAGNETO-ELECTRIC MACHINES FOR INTERNAL-COMBUSTION ENGINES. M. S. Conner and C. C. Puckette. February 10th, 1919. (136,705.)
4,149. TRANSMISSION SYSTEM FOR TRANSMITTING HIGH-FREQUENCY ELECTRIC CURRENTS. Western Electric Co. February 19th, 1919. (136,712.)
4,630. METHOD OF ELECTRICALLY WELDING PLATINUM OR OTHER METAL DISKS TO THE ENDS OR HEADS OF METAL SCREWS OR RODS. W. Meacher. February 25th, 1919. (136,720.)
4,841. INDUCTION COILS. A. H. Midgley and C. A. Vandervell & Co. February 26th, 1919. (136,722.)
9,187. APPARATUS FOR PRODUCING A CONTINUOUS ELECTRICALLY CONDUCTING LIQUID JET. J. F. G. P. Hartmann. May 11th, 1918. (136,947.)
13,655. ARC GENERATORS OF ELECTRIC OSCILLATIONS. P. O. Pedersen. March 4th, 1919. (136,762.)
22,289. AUTOMATIC VOLTAGE REGULATION OF VARIABLE-SPEED DYNAMOS. F. Mauron. September 10th, 1918. (132,518.)
23,009. TELEPHONIC ARRANGEMENT FOR USE BY FIREMEN. W. M. Burdon. September 15th, 1919. (136,791.)